INEEL/EXT-2000-00529
Revision 1

Tank Farm Soil and Groundwater Health and Safety Plan for the Operable Unit 3-14 Remedial Investigation/Feasibility Study

June 2004

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Project No. 23512

Tank Farm Soil and Groundwater Health and Safety Plan for the Operable Unit 3-14 Remedial Investigation/Feasibility Study

June 2004

Idaho Completion Project
Idaho Falls, Idaho 83415

Prepared for the
U.S. Department of Energy
Assistant Secretary for Environmental Management
Under DOE/NE Idaho Operations Office
Contract DE-AC07-99ID13727

ABSTRACT

This Health and Safety Plan describes the procedures and requirements to eliminate or mitigate health and safety risks during Phase I and Phase II tank farm soil vacuum extraction, soil drum sampling, and other activities at the Operable Unit 3-14 remedial investigation/feasibility study site at the Idaho Nuclear Technology and Engineering Center located at the Idaho National Engineering and Environmental Laboratory. This plan is required by the Occupational Safety and Health Administration standard, 29 Code of Federal Regulations 1910.120/1926.65, "Hazardous waste operations and emergency response." The plan contains information about work hazards as well as specific actions and equipment used to protect project workers.

This Health and Safety Plan contains the safety, health, and radiological hazards assessment for all Phase I and Phase II tank farm soil and groundwater tasks for the Operable Unit 3-14 remedial investigation/feasibility study. This document identifies known hazards and serves as a plan for mitigating them. The Clean/Close INTEC Subproject 6 Health and Safety Officer supporting these activities will determine the most appropriate hazard control and required mitigation measures based on site-specific conditions and will make changes to this document as appropriate.

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ACRONYMS

ALARA	as low as reasonably achievable
ARDC	Administrative Record and Document Control
BBWI	Bechtel BWXT Idaho, LLC
bls	below land surface
CC	construction coordinator
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFA	Central Facilities Area
CFR	Code of Federal Regulations
COPC	Contaminants of potential concern
CPP	(Idaho) Chemical Processing Plant (now the INTEC)
CRC	contamination reduction corridor
CRZ	contamination reduction zone
dBA	decibel A-weighted
DOE	U.S. Department of Energy
EAM	emergency action manager
ECC	emergency control center
EDF	Engineering Design File
EPA	U.S. Environmental Protection Agency
EROIS	Environmental Restoration Optical Imaging System
ERO	Emergency Response Organization
ES&H	environment, safety, and health
ESH&QA	environment, safety, health, and quality assurance
EZ	exclusion zone
FFA/CO	Federal Facility Agreement and Consent Order
FM/UL	Factory Mutual/Underwriters Laboratories, Inc.

FTL	field team leader
GM	Geiger-Mueller
HASP	health and safety plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEPA	high-efficiency particulate air
HSO	health and safety officer
ID	internal diameter
IDLH	immediately dangerous to life or health
IDW	investigation-derived waste
IH	industrial hygiene(ist)
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
ISMS	Integrated Safety Management System
JSA	job safety analysis
LO/TO	lockout/tagout
MCP	management control procedure
MSDS	material safety data sheet
NIOSH	National Institute of Occupational Safety and Health
OMP	Occupational Medical Program
OSC	on-scene commander
OSHA	Occupational Safety and Health Administration
OU	operable unit
PCM	personal contamination monitor
PEL	permissible exposure limit
PM	project manager
PNOC	particulate not otherwise classified

POD	plan of the day
PPE	personal protective equipment
PRD	program requirements document
PRG	preliminary remediation goal
QA	quality assurance
QAPjP	quality assurance project plan
RadCon	radiological control
RBA	radiological buffer area
RCIMS	Radiological Control and Information Management System
RCM	Radiological Control Manual
RCRA	Resource Conservation and Recovery Act
RCT	radiological control technician
RI/FS	remedial investigation/feasibility study
RWP	radiological work permit
SAD	site area director
SAP	sampling and analysis plan
SE	safety engineer
SH&QA	safety, health, and quality assurance
SRPA	Snake River Plain Aquifer
SS	shift supervisor
SWP	safe work permit
SZ	support zone
TLD	thermoluminescent dosimeter
TLV	threshold limit value
TPR	technical procedure
TRAIN	training records and information network

TWA	time-weighted average
UV	ultraviolet
VPP	Voluntary Protection Program
WAC	Waste Acceptance Criteria
WAG	waste area group
WCC	Warning Communications Center

Tank Farm Soil and Groundwater Health and Safety Plan for the Operable Unit 3-14 Remedial Investigation/Feasibility Study

1. INTRODUCTION

This Health and Safety Plan (HASP) describes procedures and requirements for eliminating or mitigating health and safety risks associated with tasks that support the Phase I and Phase II Tank Farm Soil and Groundwater Operable Unit (OU) 3-14 Remedial Investigation/Feasibility Study (RI/FS). These tasks, conducted at locations within the jurisdiction of the Idaho Nuclear Technology and Engineering Center (INTEC) site area director (SAD), will be performed by employees of Bechtel BWXT Idaho, LLC (BBWI) or BBWI subcontractors.

This HASP meets the requirements of the Occupational Safety and Health Administration (OSHA) standard, 29 CFR 1910.120 and 29 CFR 1926.65, "Hazardous waste operations and emergency response" (HAZWOPER). Its preparation is consistent with information found in the National Institute of Occupational Safety and Health (NIOSH)/OSHA/U.S. Coast Guard/U.S. Environmental Protection Agency (EPA) *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities* (NIOSH 1985); BBWI Safety and Health Manual (Manual 14A); BBWI Radiation Protection Procedures (Manual 15B); and BBWI Radiological Control Manual (PRD-183).

All INTEC tank farm drilling and sampling tasks will be evaluated in accordance with 10 CFR 830, "Nuclear Safety Management."

This HASP applies to all tasks at the established INTEC project site associated with the Tank Farm Soil and Groundwater RI/FS (DOE-ID 2004a). It was prepared during work scope negotiations and may not reflect actual work to be performed. Additional work scope and additional hazard introduction will require this HASP to be updated to reflect planned work activities. The updated RD/RA work plan (to be prepared) will identify the project work scope that will be reflected in this document.

This HASP was reviewed according to MCP-240, "ER/D&D&D Operational Review Board Process." The health and safety officer (HSO), in conjunction with the field team leader (FTL) and the INTEC environment, safety, health, and quality assurance (ESH&QA) manager or designee, will review the HASP to ensure its effectiveness and suitability throughout the project and revise the plan if necessary. The Clean/Close INTEC Subproject 6 health and safety officer will be included on all document action requests to revise this HASP.

1.1 INEEL Site Description

The Idaho National Engineering and Environmental Laboratory (INEEL) is a DOE-managed U.S. government test site located in southeastern Idaho, 51.5 km (32 mi) west of Idaho Falls (Figure 1-1). The INEEL encompasses approximately 2,305 km^2 (890 mi^2) of the northeastern portion of the Eastern Snake River Plain. The Eastern Snake River Plain is a relatively flat, semiarid, sagebrush desert, with predominant relief being manifested either as volcanic buttes jutting up from the desert floor or as unevenly surfaced basalt flows or flow vents and fissures. Elevations on the INEEL range from 2,003 m (6,572 ft) in the southeast to 1,448 m (4,750 ft) in the central lowlands, with an average elevation of 1,516 m (4,975 ft). Drainage within and around the plain recharges the Snake River Plain Aquifer (SRPA), which flows beneath the INEEL and surrounding area and has been designated by the EPA as a sole source aquifer for the region.

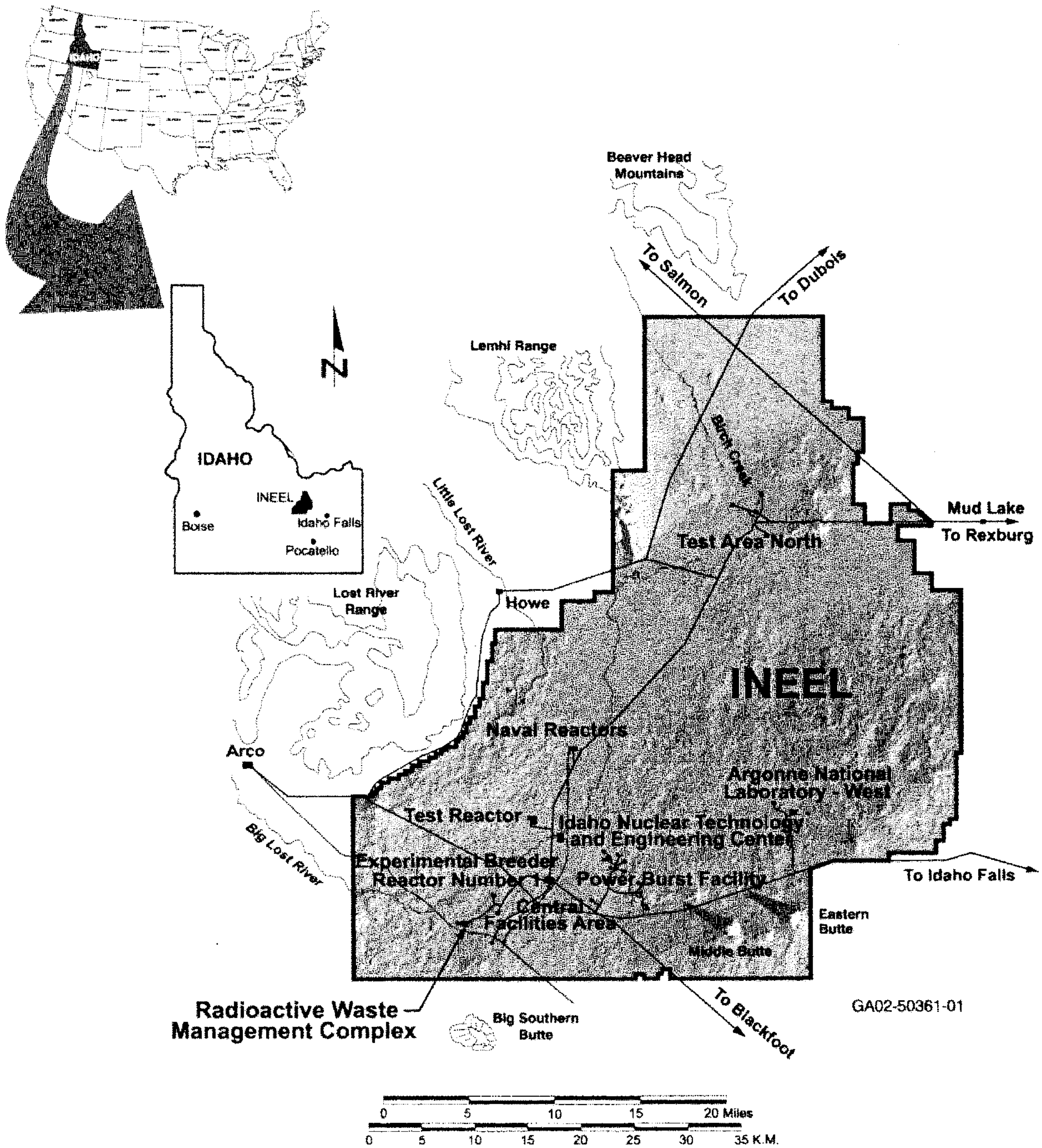

Figure 1-1. Map of the INTEC at the INEEL.

The U.S. Atomic Energy Commission initially established the INEEL in 1949 as the National Reactor Testing Station for nuclear energy research and related activities. In 1952, the INEEL expanded its function and began accepting shipments of transuranic radionuclides and radioactive low-level waste. In 1974, it was redesignated the Idaho National Engineering Laboratory (INEL) and then the INEEL in 1997 to reflect the expansion of its mission to include a broader range of engineering and environmental management activities. Currently, the INEEL supports the engineering efforts and operations of the DOE and other federal agencies in areas of nuclear safety research, reactor development, reactor operations and training, nuclear defense materials production, waste management technology development, and energy technology and conservation programs. The DOE-Idaho Operations Office (DOE-Idaho) has responsibility for the INEEL and delegates authority to operate the INEEL to government contractors. BBWI provides managing and operating services to the majority of INEEL facilities for DOE-Idaho.

In November 1989, because of confirmed contaminant releases to the environment, the EPA placed the INEEL on the National Priorities List of the National Oil and Hazardous Substances Pollution Contingency Plan (54 FR 48184). In response to this listing, the DOE, the EPA, and the State of Idaho (collectively called the Agencies) negotiated a Federal Facility Agreement and Consent Order (FFA/CO) and Action Plan (DOE-ID 1991). The FFA/CO and Action Plan, signed in 1991 by DOE-ID (now DOE-Idaho), EPA, and the State of Idaho Department of Environmental Quality, established the procedural framework and schedule for developing, prioritizing, implementing, and monitoring response actions at the INEEL in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (42 USC § 9601 et seq.), the Resource Conservation and Recovery Act (RCRA) (42 USC § 6901 et seq.), and the Idaho Hazardous Waste Management Act (HWMA) (HWMA 1983).

To better manage cleanup activities, the INEEL was divided into 10 waste area groups (WAGs); INTEC is designated as WAG 3. Each WAG contains a number of contaminant release sites grouped into OUs based on similarity of waste streams and projected remedial actions. Fourteen OUs have been defined for WAG 3. Operable Units 3-01 through 3-13 are addressed in the OU 3-13 Record of Decision (ROD) (DOE-ID 1999). OU 3-14 will address the final action for the tank farm soil and the portion of the SRPA within the perimeter of the INTEC.

1.2 Site History

The INTEC, located in the south-central portion of the INEEL, commenced operations in 1952. Historically, the INTEC has been a uranium reprocessing facility for both defense projects and research and was also used as a spent nuclear fuel storage facility. Irradiated defense nuclear fuels were reprocessed to recover unused uranium. Liquid waste from reprocessing was either stored at the INTEC tank farm for treatment at the calcining facility or disposed of in the INTEC injection well (CPP-23).

After fuel dissolution and extraction, the liquid waste was calcined, and the resultant granular solids were stored in stainless steel bins. Depending on the type of fuel reprocessing, several types of high-level radioactive liquid waste were produced at the INTEC. Phaseout of INTEC reprocessing activities began in 1992. This phaseout includes fuel dissolution, solvent extraction, product denitration, and other processes. After phaseout is complete, the INTEC mission will be to receive and store spent nuclear fuel and radioactive waste for future disposition. Figure 1-2 is a map of the tank farm location within INTEC.

Tank farm soil is defined as the soil from the surface down to the uppermost basalt flow (an average of 45 ft [14 m]), is composed primarily of alluvial and fluvial deposits covered by a mantle of loess and fluvial soil, and includes release sites in OU 3-14 (3-06, 3-07, 3-08, and 3-11). These sites are located in the area of the tank farm. These sites are referred to as the tank farm soil sites, all of which are consolidated in Site CPP-96. Specifically, CPP-96 is a consolidation of CPP-15, CPP-16, CPP-20,

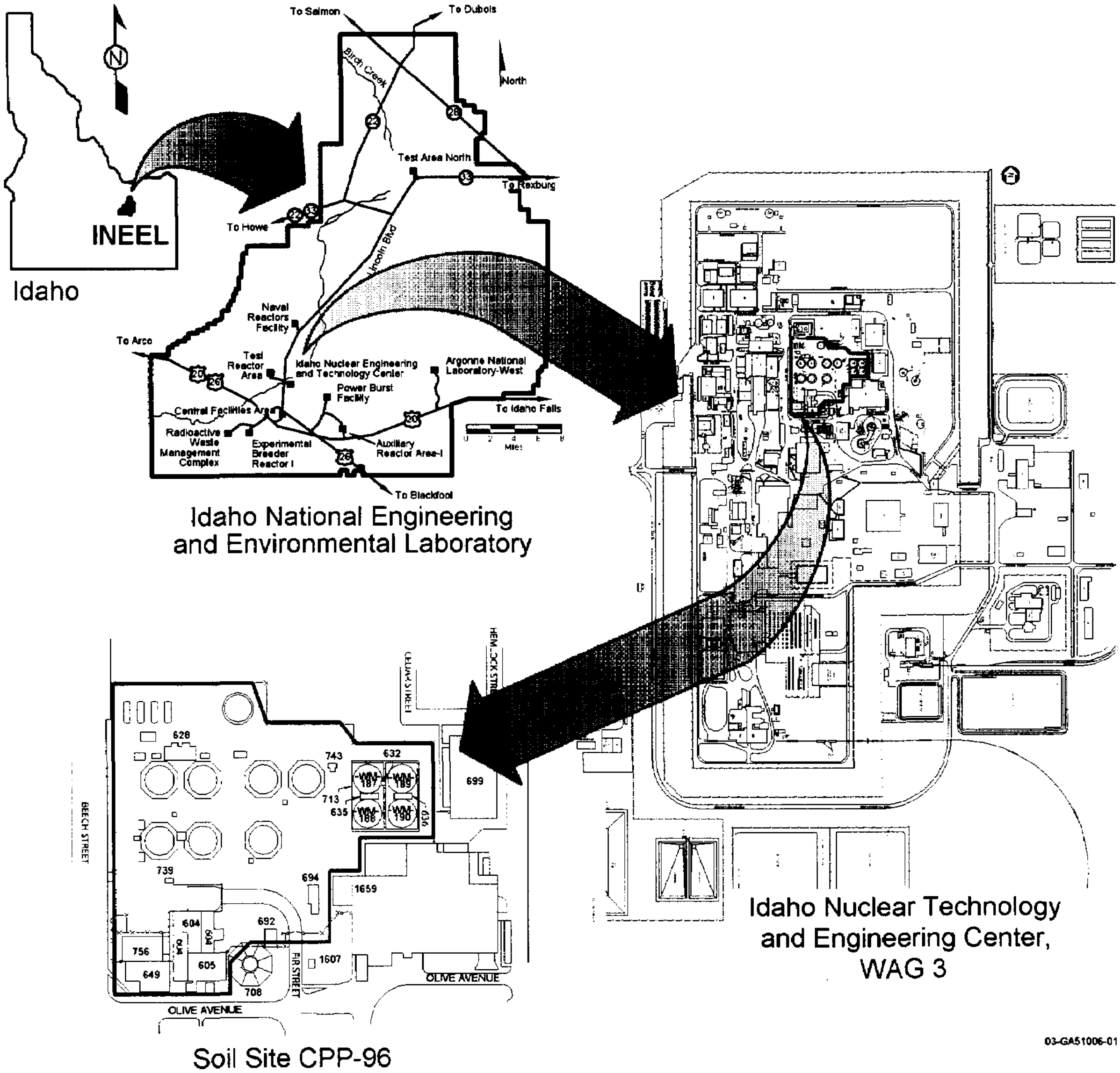

Figure 1-2. Location of tank farm within INTEC.

CPP-24, CPP-25, CPP-26, CPP-27, CPP-28, CPP-30, CPP-31, CPP-32, CPP-33, CPP-58, CPP-79, and CPP-96. The OU 3-14 Field Sampling Plan (FSP) (DOE-ID 2004b) depicts the OU 3-14 tank farm soil area.

The tank farm soil has been contaminated by spills and pipeline leaks of radioactive liquids from plant and transfer operations. In addition to the known highly contaminated areas, low levels of contamination exist at varying locations and depths. Little is known regarding the extent (both vertical and horizontal) of contamination, volume of spilled material, types of contaminants, and contamination levels because many of the spill sites are in areas that are operational and highly radioactive. The principal threats posed by contaminated tank farm soil are external exposure to radiation and leaching and transport of contaminants to the perched water or SRPA. The tank farm soil is known to or suspected to contain the following primary contaminants above risk levels: Cs-137, Eu-154, Pu-238, Pu-239/240, Pu-241, Sr-90, U-235, and mercury. Other contaminants known to be in the tank farm soil include

Am-241, arsenic, Ce-144, Cs-134, Co-60, Np-237, nitrates, Ru-106, Tc-99, thallium, tritium, U-234, U-236, and zirconium.

The tank farm is an operational facility under which lies a multitude of pipes and subsurface structures. An INTEC-specific management control procedure (MCP) that specifies the equipment load limit in the tank farm area was developed to address this issue.

1.3 Scope and Objectives

The purpose of this HASP is a hazard identification and mitigation guide for the collection of environmental data in order to fully characterize the extent, distribution, and composition of radionuclide contamination in soils located at identified release sites at the INTEC tank farm. A map indicating locations of the tank farm at the INTEC is provided in Figure 1-2.

The tank farm soil has been contaminated by radioactive liquids due to past spills and pipeline leaks from plant and transfer operations. In addition to several known highly contaminated areas, low levels of contamination are suspected to exist at varying locations and depths throughout the tank farm subsurface. Contaminant type, concentration, and areal extent of known spill volumes are incompletely characterized for some spill locations. Additionally, specific waste transfer piping configurations or materials identified as suspect (due to releases from similar configurations or materials in the past) will be investigated. According to the *Final Record of Decision, Idaho Nuclear Technology and Engineering Center, Operable Unit 3-13, Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho* (DOE-ID 1999), the principal threats posed by contaminated tank farm soil are external radiation exposure and contamination of underlying perched groundwater and the SRPA.

The tank farm soil is defined as soil from the surface to the uppermost underlying basalt flow. It includes release Sites CPP-15, CPP-16, CPP-20, CPP-24, CPP-25, CPP-26, CPP-27/33, CPP-28, CPP-30, CPP-31, CPP-32, CPP-58, and CPP-79. Figures 4-1 through 4-6 in the OU 3-14 FSP (DOE-ID 2004b) illustrate the tank farm release sites.

This investigation involves a two-phase approach to focus project resources on maximizing information gained in the field to define radiological hotspots, while minimizing unnecessary sampling and characterization efforts. The overall objective of this field characterization is to provide technical data to support the baseline risk assessment and feasibility study phases of the OU 3-14 RI/FS.

The purpose of the Phase I field investigation is to define the extent and distribution of radionuclide contamination in the subsurface for known release sites. Subsurface radiation logging will be conducted in existing and new probeholes. New probeholes will be installed and surveyed for gamma radiation at various tank farm sites to be defined in the OU 3-14 RI/FS (DOE-ID 2004a). Locations for new probeholes have been proposed using best judgment based on the location of known release sites and whether the extent and distribution of contamination have been delineated at those sites. The subsurface gamma radiation surveys will be used to produce log plots showing variations in gamma-ray flux at depth. Correlation between log plots will be used as a basis to estimate the combined horizontal and vertical extent of soil contamination zones.

Phase II of the characterization effort will involve collecting and analyzing soil samples for specified COPCs. Soil samples will be collected at locations to be specified based on results of the subsurface gamma radiation survey completed during Phase I field activities.

Phase I

Subsurface Gamma Radiation Survey: Assess the extent of subsurface radionuclide contamination within the tank farm soil investigation area utilizing existing probeholes and new probeholes to be installed at proposed locations identified in the RI/FS Work Plan.

Phase I field effort objectives are as follows:

- Define the spatial extent and distribution of contaminants of potential concern (COPCs) at known release sites at concentrations above preliminary remediation goals (PRGs) for direct exposure to soils. All tank farm releases are known to have contained high concentrations of gamma-emitting radionuclides, including Cs-137; therefore, the Phase I investigation will focus on determining spatial extent and distribution (e.g., locations of hotspots) of gamma-emitting radionuclides.

- Identify locations where soil samples will be collected during Phase II field activities based on the spatial extent and distribution of COPCs.

Phase II

Direct-Push Soil Sampling: Assess the composition of contaminants at locations defined during Phase I characterization efforts by collecting soil samples using direct-push technology. In addition, in-place soil density testing will be completed at release Sites CPP-28, CPP-31, and CPP-79.

Phase II field effort objectives are as follows:

- Define the composition of radiological contamination at locations defined during the Phase I field effort.

Gamma radiation activity will then serve as an indicator of zones where other COPCs are most likely to occur. Cesium-137 soil contamination is expected to be the principal source of the mapped radiation fields, as it has been found in all contamination zones discovered in the tank farm to date.

1.4 Sampling Methods

Phase I downhole in situ radiation measurements will be used to detect gamma-ray emitters. Cs-137 will be the predominant gamma-ray emitter and will serve as an indicator to direct Phase II sampling for additional analytes of concern in specific areas of interest.

The planned subsurface small-diameter logging system will consist of a gamma-ray sonde that is capable of detecting the 662-keV gamma-ray emitted by Cs-137 through steel casing to a minimum detection level of 3 pCi/g. This system and its capabilities are discussed in detail in Sections 4.2 and 5.2 of the OU 3-14 FSP (DOE-ID 2004b).

Phase II soil sampling will be completed using direct-push technology as outlined in Sections 4.5 and 6.2 of the FSP (DOE-ID 2004b). In-place soil density testing will be conducted at release Sites CPP-28, CPP-31, and CPP-79 as described in Section 4.6 of the FSP (DOE-ID 2004b).

1.5 Phase I Predrilling Using Vacuum Excavator

New probeholes will be installed in allowance with the FSP (DOE-ID 2004b). The presence of buried pipes, valve boxes, and other infrastructure elements associated with past and present tank farm operations creates a substantial hazard for any invasive activities within the tank farm soil. If an infrastructure feature was struck by drilling or excavation equipment, a contaminant release could occur. Since the tank farm infrastructure occurs almost exclusively within the depth interval from 0 to 3.7 m (0 to 12 ft), probe and/or instrument installation through the upper soil zone may be accomplished using a vacuum excavation system to prevent damage to the infrastructure. If the vacuum excavation technique proves impractical because of radiological concerns, then pilot borings may be completed using a hand auger.

Vacuum excavation technology involves the use of a high-pressure jet of air, directed by a nozzle called an air lance, to penetrate, expand, and break up soil. Soil material, including rock and debris, is removed by a 4-in.-diameter vacuum hose to a drum or similar receptacle (anticipated to be 35 or 55 gal). This process is a closed-loop system, thereby reducing the risk of an air release. Vacuum excavation advances the probehole without damaging underground pipelines or utilities.

The vacuum excavator may be used to excavate a pilot hole 7.6 to 12.7 cm (3 to 5 in.) in diameter to a depth of 4.6 m (15 ft) bls. A schematic of the probehole installation is shown in Figure 4-7 of the FSP. If subsurface piping or other infrastructure is encountered, the probehole location will be abandoned in favor of a new location at a nearby position, unless the probehole casing can be placed safely adjacent to the obstacle. Soil will be excavated in 1.5-m (5-ft) increments (0 to 1.5 m [0 to 5 ft], 1.5 to 3 m [5 to 10 ft], 3 to 4.5 m [10 to 15 ft]) and stored temporarily in drums labeled according to hole position and depth.

Pilot holes will extend from ground surface to approximately 4.5 m (15 ft) bls to safely penetrate through soil and avoid tank farm piping or other obstructions associated with past and present tank farm operations. Prior to any excavation, the proposed locations will be surveyed, staked, preapproved by management, and verified, based on drawings and historical documentation. The material will be screened for radiological contamination with a hand-held beta/gamma detector and will be drummed and stored as investigation-derived waste (IDW) by the INTEC environmental coordinator or WAG personnel assigned to the project.

Since the vacuum excavator will be using air to remove soil from the probehole, cross contamination between probeholes should not be significant relative to the nature of the measurements (downhole gamma-ray survey) being made in the completed probeholes. The amount of contamination that can be carried from the vacuum hose and air lance should be negligible relative to the volume of soil being removed. Furthermore, the probehole investigation is planned to generally proceed from the least contaminated areas to the most contaminated areas. If extensive contamination is identified in the air lance and associated hosing, the contaminated equipment will be discarded and new equipment used.

After successful completion of pilot holes using the vacuum excavator, steel probehole casing will be installed to the bottom of the hole. Bentonite chips will be used to backfill the annulus between the casing and the probehole wall, if necessary. This procedure will permit probehole casings to be installed with minimal void space for a more accurate reading of that specific location. Probe construction techniques will be selected after the development of technical and functional requirements for this activity.

Vacuum excavation may alter the soil media characteristics within the immediate vicinity of the probehole. This upper disturbed zone (0-15 ft bls) may affect gross gamma logging measurements. This upper disturbed zone may be logged if it is determined that useable data are being collected. Because of the influence of the disturbed zone surrounding the probe, these measurements may not be directly comparable to sample results obtained by logging deeper undisturbed intervals. Gross gamma results will be reviewed to determine if the information is considered representative of the soil contamination at that location. High levels of gamma activity in the upper 15 ft of the boring will tend to minimize possible error in the measurements obtained. If gamma activity in the soil is in the lower range of the minimum detection level for the instrument used (approaching 3 pCi/g Cs-137), then a larger error could be expected in the gross gamma measurements. Concerns that the logging results may be suspect due to soil vacuuming or backfilling around the casing in the upper 15 ft of the borings may limit the usability of gross gamma data obtained in the upper 15 ft of the probeholes.

1.6 Phase I Direct-Push Drilling in Tank Farm Soil

Several manufacturers produce a direct-push system capable of installing a steel probe to a depth of approximately 14.5 m (50 ft), which is the anticipated average depth to basalt at the tank farm. These systems use a truck-mounted power unit or power-take-off unit to power the hydraulic push system. This system is coupled with a hydraulic hammer to assist in installation by pounding on the casing. This configuration was successfully demonstrated at INTEC in 2001. The technique proved capable of rapidly installing casing to the depth of the basalt/alluvium interface (INEEL 2001). This procedure complies with the vibration limitations in place at the time Section 2.4 of INEEL (2001) was written. This method will result in installation of the probehole casings without creating drill cuttings. This method also will allow installation of the casings without the need for containment and excessive PPE requirements.

A direct-push rig will be used in the tank farm to install the additional probeholes for downhole gross gamma logging. The steel drive casing will be attached in 1.2-m (4-ft) or 1.52-m (5-ft) lengths (depending on the type of tooling used) as the probehole is advanced. The steel casing will have a minimum inside diameter (ID) of 4.45 cm (1.75 in.) or as required for type of gamma logging sonde that is used. Upon reaching the basalt, or refusal, pushing/hammering will cease and the casing will be detached from the rig at the lowest possible position to maintain an aboveground completion. Exceptions may be made in specific areas determined by tank farm personnel, as some probeholes may be completed at ground surface. The casing will be capped with an all-weather cap to prevent entry of unwanted materials. All boring locations will be surveyed to establish exact locations.

The direct-push rig will be surveyed by the radiological control technical (RCT) using a hand-held radiation detection monitor (Ludlum 2a or equivalent), and smears will be collected if deemed necessary by the RCT. If no contamination is detected, the rig will be moved to the next probehole location. If contamination is found, attempts to remove the contamination, using dry decontamination (or other decontamination methods stipulated by the RCT), will be performed. When the rig is connected to the next probehole casing, the installation procedure will be repeated.

If a boring cannot be completed to basalt, written documentation will be provided explaining why moving the probehole location is necessary. If the probehole cannot be completed in the revised location, an entry will be made in the logbook and serve as formal documentation. The Agencies will be subsequently notified. The casing will not be removed from the tank farm soil, because of the possible radiation exposure to workers and the environment. Rather, it will be capped and left in place.

1.6.1 Direct-Push Probehole Installation

Probeholes shall be installed using a hydraulically powered, direct-push probing rig (e.g., AMS PowerProbe, Geoprobe, Stratoprobe) to advance a minimum 4.45-cm (1.75-in) ID (3-in OD) hollow probehole casing with a threaded drive point from the land surface to the sediment/basalt. This will allow for in situ characterization of radiological contamination as indicated by gross gamma. Once the hollow probehole casing has been advanced to the sediment/basalt interface or until refusal, the probing rig/vehicle will relocate to another probehole location. Final depths of each probehole will vary based on the depth of the sediment/basalt interface. Soil will be displaced laterally with the direct-push monitoring probehole installation, thus eliminating accumulation of surface drill cuttings. The probeholes will be logged with an in situ (downhole) radionuclide assay system to detect gamma radiation. Gross gamma results obtained may be used to guide installation of subsequent borings. If proposed boring locations are changed because of information obtained in the field, all required excavation clearances must be obtained prior to commencing the boring. The installation of the probes will proceed as follows:

- After vacuum excavation or hand-augering to 4.6 m (15 ft) has been completed (if required) and no subsurface structures have been encountered, a minimum 4.45-cm (1.75-in.) ID probehole casing with a threaded drive point will be installed and direct-push advanced until the sediment/basalt interface is encountered. The threaded probehole casing will be advanced in 1.2-m (4-ft) or 1.52-m (5-ft) sections, depending on the tooling that is used. Real-time radiological field screening activities will be conducted as probing through the surface sediments occurs, and readings with estimated depths will be recorded in the field notes.

- Once the probehole casing has been advanced to the final depth, the drill rig will move off the probe site. If required by the RCT, radioisotope smears of push probe equipment will be collected and analyzed prior to movement of the vehicle to the next location. Once the rig is approved as clean by the RCT, the rig will be set up at another probing location. All probehole casing threaded drive points will be left in place to allow access for downhole gamma radiation logging.

Immediately after installation, each probehole will be logged from bottom to top with a small-diameter gross gamma sonde system to screen for gross gamma contamination. Gross gamma results obtained may be used to guide installations of subsequent borings.

1.7 Phase I Hand-Augering

Some boreholes may be hand-augered using a 4-in. outside diameter (OD) hand auger or smaller diameter, as applicable, to the top of the tank vault, approximately 6 ft bls, or these borings may be installed with the vacuum lance as appropriate. The purpose of using a hand auger at this location is to avoid any damage to the concrete vault. Upon reaching total depth, the hand auger will be removed from the hole and the steel probehole casing will be installed. The annular space between the casing and the bore wall will be filled with bentonite chips, as necessary. Soil material, including rock and debris, will be placed into a drum or similar receptacle approved by INEEL RadCon. It could be expected that about 0.1 ft^3 of soil per foot of depth would be removed from a 4-in.-diameter boring. Alternatively, the three borings that will be over the tank vault may be completed using the vacuum lance system.

1.8 Phase II Soil Sampling

This section outlines the soil sampling procedure using direct-push equipment, field decontamination procedures, and sample packaging requirements for completion of Phase II soil sampling.

A direct-push rig with a dual-tube sampling system will be used to minimize cross contamination and maximize sample integrity and recovery rate. One set of rods is driven into the ground as an outer casing. These rods receive the driving force from the hammer and provide a sealed hole from which soil samples may be recovered without the threat of cross contamination. The second, smaller set of rods is placed inside the outer casing. The smaller rods hold a sample liner in place as the outer casing is driven one sampling interval. The small rods are then retracted to retrieve the filled liner while the outer rods are left in place. After any needed decontamination, the sampling tool and inner rods can then be returned down the open case, and sampling can continue to the next sampling interval.

The dual-tube sampling system is recommended in sandy or loamy soils, where the borehole might collapse. The outer tubing acts as a support for the borehole and allows the soil sample to be collected without the risk of inadvertently collecting soil from shallower depths that fell into the open borehole. The dual-tube soil sampling system is also recommended for use in highly contaminated soils. The outer tube prevents cross contamination of a soil sample with material from other depths.

RadCon will survey samples using a hand-held instrument (Ludlum 2A or equivalent) as they are withdrawn from the boring. Specifications regarding handling of soil samples at various activity levels at the surface (i.e., opening sample liners, transferring soil from the liner to sample bottles, storage of samples) will be addressed in a radiological work permit (RWP) and an as-low-as-reasonably-achievable (ALARA) review. These documents will be developed prior to commencing field activities.

All samples will be contained in precleaned and laboratory-certified bottles provided by the laboratory and prepared in accordance with EPA bottle-washing procedures and preservation requirements. All samples will be properly preserved and stored until they are shipped to the appropriate analytical laboratory per requirements outlined in the Quality Assurance Project Plan (QAPjP) (DOE-ID 2004c), RWP, and ALARA review. If the radioactivity present in the soil samples is such that handling must be minimized, then the soil samples will be left in the sample liner. The samples will be collected by cutting the sample liner into lengths containing the required amount of soil, capping the ends of the sections of core tube, labeling the core section appropriately, and delivering the sample to the lab. All sampling locations will be surveyed to establish exact locations.

1.8.1 Protective Equipment Sampling

Personal protective equipment (PPE) and miscellaneous debris (investigation-derived waste) generated from the Phase I and Phase II tank farm soil and groundwater OU 3-14 RI/FS activities may be sampled for constituents of concern in support of a hazardous waste determination for final disposition.

2. HAZARD IDENTIFICATION AND MITIGATION

The overall objectives of this hazard identification and mitigation section is to provide guidance on the following:

- Evaluating all drilling, logging, and sampling tasks to determine the extent that existing radiological, chemical, and physical hazards may potentially affect site personnel by all routes of entry

- Establishing the necessary monitoring and sampling required to validate exposure and contamination levels, determine adequate action levels to mitigate potential exposures, and provide specific actions to be followed if action levels are reached

- Determining engineering controls, isolation methods for contaminated materials, work practices to limit personnel exposure, administrative controls, and appropriate respiratory protection and protective clothing to protect site personnel from site hazards.

This HASP has been developed in accordance with MCP-2748, "Hazardous Waste Operations and Emergency Response," and follows the hazard identification, evaluation, and mitigation process found in PRD-25, "Activity Level Hazard Identification, Analysis, and Control."

The magnitude of or danger presented by hazards to personnel entering work zones is dependent on both the nature of tasks being performed and the proximity of personnel to the hazards. Engineering controls will be implemented (whenever possible) along with administrative controls, work practices, and PPE to mitigate potential exposures and hazards. Hazard mitigation provided in this section in combination with other work controls (e.g., technical procedures, work orders, JSA, and GDE–6212, "Hazard Mitigation Guide for Integrated Work Control Process") will be used, where applicable, to eliminate or mitigate project hazards.

2.1 Chemical and Radiological Hazards and Mitigation

Personnel may potentially be exposed to safety hazards and chemical, radiological, and physical agents during Phase I and Phase II tank farm soil and groundwater OU 3-14 RI/FS tasks. The potential hazards to personnel entering the work zones are dependent on both the chemical/radiological nature of the encountered contaminants and the specific task. Engineering controls will be implemented whenever possible, along with work practice controls (administrative), real-time monitoring of contaminants, and site-specific hazard training to further mitigate potential exposures and hazards. Formal preplanning (job walk-down and completion of the prejob briefing checklist), JSA, and other work control permits will be written based on the hazards identified in this HASP and site-specific conditions. Collectively, this documentation and training will be used to identify and mitigate potential hazards and provide feedback for lessons learned during previous sampling tasks.

Tables in this section identify the potential chemical, radiological, and physical hazards that may be encountered during Phase I and Phase II tank farm soil and groundwater OU 3-14 RI/FS tasks, as well as monitoring methods, action limits, and other hazard-specific mitigation measures. These radiological and nonradiological contaminants represent the primary health hazards to personnel during drilling and sampling operations and are not intended to represent all contaminants of potential concern identified in the Phase I and Phase II FSP (DOE-ID 2004b).

The tables in this section include

- Table 2-1—Radionuclide COCs for personnel conducting drilling and sampling tasks. The COCs listed are associated with the specific sites they may be located within.

- Table 2-2—Nonradiological COCs for personnel conducting drilling and sampling tasks. These are the maximum values detected in samples previously collected from the WAG 3 OU 3-14 tank farm area.

- Table 2-3—Evaluation of radiological and nonradiological contaminants detected in samples previously collected from the WAG 3 OU 3-14 tank farm area with respect to potential routes of exposure, symptoms of overexposure, and qualitative exposure risk potential based on the nature of the contamination, work tasks, and source term (concentration)

- Table 2-4—Summary of each primary project task, associated hazards, and mitigation

- Table 2-5—WAG 3 OU 3-14 tank farm investigation and sampling hazards (radiological and nonradiological) to be monitored by the industrial hygiene (IH) and radiological control (RadCon) personnel

- Table 2-6—Equipment available for monitoring radiological and nonradiological hazards

- Table 2-7—Action levels and associated responses for specific sampling hazards.

Nonradiological contaminants were detected during previous sampling. Table 2-2 lists the COCs with respect to potential exposure. Based on the nature of the contaminants in the tank farm soil (radiological and nonradiological), the primary potential for exposure during drilling, logging, and sampling tasks will be from radiological hazards. Engineering controls, experienced drillers and samplers, administrative controls (limiting access to the area), worker personal protective clothing, personnel and area monitoring, and adherence to RWPs will minimize personnel exposure to radiological and nonradiological contaminants.

Previous sampling of the WAG 3 OU 3-14 tank farm area quantified contaminant levels for soil sent for disposal. The samples are considered to be representative of the tank farm. Radionuclides were detected in samples and the primary radionuclides of concern are listed on Table 2-3.

JSAs and RWPs will be used in conjunction with this HASP to address hazardous and radiological conditions at the site. These work control documents will augment this HASP and provide further details about specialized protective equipment and dosimetry requirements during sampling tasks.

Table 2-1. Radionuclide contaminants of concern (COCs) by site identification of WAG 3, OU 3-14 tank farm tasks.

Site-Specific COC List	CPP-15	CPP-20	CPP-25	CPP-26	CPP-27	CPP-28	CPP-31	CPP-32 (E)	CPP-33	CPP-58 (E)	CPP-58 (W)	CPP-79
Radionuclide												
Ac-227	—[a]	—	—	—	—	—	—	—	—	—	—	—
Ag-108m	—	—	—	—	—	—	—	—	—	—	—	—
Am-241	X	—	—	X	X	—	—	X	X	—	—	X
Am-242m	—	—	—	—	—	—	—	—	—	—	—	—
Am-243	—	—	—	—	—	—	—	—	—	—	—	—
Be-10	—	—	—	—	—	—	—	—	—	—	—	—
Bi-210m	—	—	—	—	—	—	—	—	—	—	—	—
C-14	—	—	—	—	—	—	—	—	—	—	—	—
Cd-113m	—	—	—	—	—	—	—	—	—	—	—	—
Ce-142	—	—	—	—	—	—	—	—	—	—	—	—
Cf-249	—	—	—	—	—	—	—	—	—	—	—	—
Cf-250	—	—	—	—	—	—	—	—	—	—	—	—
Cf-251	—	—	—	—	—	—	—	—	—	—	—	—
Cl-36	—	—	—	—	—	—	—	—	—	—	—	—
Cm-243	—	—	—	—	—	—	—	—	—	—	—	—
Cm-244	—	—	—	—	—	—	—	—	—	—	—	—
Cm-245	—	—	—	—	—	—	—	—	—	—	—	—
Cm-246	—	—	—	—	—	—	—	—	—	—	—	—
Cm-247	—	—	—	—	—	—	—	—	—	—	—	—
Cm-248	—	—	—	—	—	—	—	—	—	—	—	—
Cm-250	—	—	—	—	—	—	—	—	—	—	—	—

Table 2-1. (continued).

Site-Specific COC List	CPP-15	CPP-20	CPP-25	CPP-26	CPP-27	CPP-28	CPP-31	CPP-32 (E)	CPP-33	CPP-58 (E)	CPP-58 (W)	CPP-79
Cs-135	—	—	—	—	—	—	—	—	—	—	—	—
Cs-137	X	—	—	X	X	—	—	X	X	X	—	X
Eu-150	—	—	—	—	—	—	—	—	—	—	—	—
Eu-152	—	—	—	—	—	—	—	—	—	—	—	—
Gd-152	—	—	—	—	—	—	—	—	—	—	—	—
H-3	—	—	—	—	—	—	—	—	—	—	—	—
Ho-166m	—	—	—	—	—	—	—	—	—	—	—	—
I-129	X	—	—	—	—	—	—	—	X	—	—	—
In-115	—	—	—	—	—	—	—	—	—	—	—	—
La-138	—	—	—	—	—	—	—	—	—	—	—	—
Nb-93m	—	—	—	—	—	—	—	—	—	—	—	—
Nb-94	—	—	—	—	—	—	—	—	—	—	—	—
Nd-144	—	—	—	—	—	—	—	—	—	—	—	—
Ni-59	—	—	—	—	—	—	—	—	—	—	—	—
Ni-63	—	—	—	—	—	—	—	—	—	—	—	—
Np-236	—	—	—	—	—	—	—	—	—	—	—	—
Np-237	X	—	—	—	—	—	—	—	X	—	—	—
Pa-231	—	—	—	—	—	—	—	—	—	—	—	—
Pb-210	—	—	—	—	—	—	—	—	—	—	—	—
Pd-107	—	—	—	—	—	—	—	—	—	—	—	—
Pu-238	X	—	—	X	X	—	—	X	X	X	—	X
Pu-239	X	—	—	X	X	—	—	X	X	X	—	X
Pu-240	X	—	—	X	X	—	—	X	X	—	—	X

Table 2-1. (continued).

Site-Specific COC List	CPP-15	CPP-20	CPP-25	CPP-26	CPP-27	CPP-28	CPP-31	CPP-32 (E)	CPP-33	CPP-58 (E)	CPP-58 (W)	CPP-79
Pu-241	—	—	—	—	—	—	—	—	—	X	—	—
Pu-242	—	—	—	—	—	—	—	—	—	—	—	—
Pu-244	—	—	—	—	—	—	—	—	—	—	—	—
Ra-226	—	—	—	—	—	—	—	—	—	—	—	—
Rb-87	—	—	—	—	—	—	—	—	—	—	—	—
Se-79	—	—	—	—	—	—	—	—	—	—	—	—
Si-32	—	—	—	—	—	—	—	—	—	—	—	—
Sm-146	—	—	—	—	—	—	—	—	—	—	—	—
Sm-147	—	—	—	—	—	—	—	—	—	—	—	—
Sm-148	—	—	—	—	—	—	—	—	—	—	—	—
Sm-149	—	—	—	—	—	—	—	—	—	—	—	—
Sm-151	—	—	—	—	—	—	—	—	—	—	—	—
Sn-121m	—	—	—	—	—	—	—	—	—	—	—	—
Sn-126	—	—	—	—	—	—	—	—	—	—	—	—
Sr-90	X	—	—	X	X	—	X	X	X	X	—	X
Tc-98	X	—	—	—	—	—	—	—	—	—	—	—
Tc-99	X	—	—	—	—	—	—	—	—	—	—	—
Tc-123	—	—	—	—	—	—	—	—	—	—	—	—
Th-229	—	—	—	—	—	—	—	—	—	—	—	—
Th-230	—	—	—	X	—	—	—	X	—	—	—	X
Th-232	—	—	—	X	—	—	—	X	—	—	—	X
U-232	—	—	—	—	—	—	—	—	—	—	—	—
U-233	—	—	—	—	—	—	—	—	—	—	—	—

Table 2-1. (continued).

Site-Specific COC List	CPP-15	CPP-20	CPP-25	CPP-26	CPP-27	CPP-28	CPP-31	CPP-32 (E)	CPP-33	CPP-58 (E)	CPP-58 (W)	CPP-79
U-234	X	—	—	X	X	—	—	X	X	X	—	X
U-235	X	—	—	X	X	—	X	X	X	X	—	X
U-236	—	—	—	—	—	—	—	—	—	—	—	—
U-238	X	—	—	X	X	—	—	X	X	X	—	X
V-50	—	—	—	—	—	—	—	—	—	—	—	—
Zr-93	—	—	—	—	—	—	—	—	—	—	—	—

a. Indicates the specific analyte has not been sampled for at the specific site.

Table 2-2. Nonradiological COCs associated with WAG 3 OU 3-14 tank farm tasks.

Site-Specific COC List	CPP-15	CPP-20	CPP-25	CPP-26	CPP-27	CPP-28	CPP-31	CPP-32 (E)	CPP-33	CPP-58 (E)	CPP-58 (W)	CPP-79
RCRA Inorganics												
Aluminum	—[a]	—	—	—	—	—	—	—	—	—	—	—
Antimony	X	—	—	—	—	—	—	—	—	—	—	—
Arsenic	—	—	—	—	—	—	—	—	X	—	—	—
Barium	—	—	—	—	—	—	—	—	X	—	—	—
Beryllium	—	—	—	—	—	—	—	—	—	—	—	—
Cadmium	—	—	—	X	X	—	—	X	X	X	—	X
Chromium	—	—	—	X	—	—	—	X	X	—	—	X
Cobalt	—	—	—	—	—	—	—	—	—	—	—	—
Copper	—	—	—	—	—	—	—	—	—	—	—	—
Fluoride	—	—	—	X	X	—	—	X	—	X	—	X
Iron	—	—	—	—	—	—	—	—	—	—	—	—
Lead	—	—	—	—	—	—	—	—	X	—	—	—
Manganese	—	—	—	X	—	—	—	X	X	—	—	X
Mercury	X	—	—	X	X	—	—	X	X	X	—	X
Nickel	—	—	—	X	—	—	—	X	—	—	—	X
Selenium	X	—	—	—	—	—	—	—	X	—	—	—
Silver	X	—	—	—	—	—	—	—	X	—	—	—
Thallium	X	—	—	—	—	—	—	—	—	—	—	—
Vanadium	—	—	—	—	—	—	—	—	—	—	—	—
Zinc	—	—	—	—	—	—	—	—	—	—	—	—
RCRA Organics												
Acetone	X	—	—	X	—	—	—	X	X	—	—	X
Benzene	X	—	—	X	—	—	—	X	X	—	—	X
Bromomethane	X	—	—	X	—	—	—	X	X	—	—	X
Carbon disulfide	X	—	—	X	—	—	—	X	X	—	—	X
Carbon tetrachloride	X	—	—	X	—	—	—	X	X	—	—	X
Chloroethane	X	—	—	X	—	—	—	X	X	—	—	X

Table 2-2. (continued).

Site-Specific COC List	CPP-15	CPP-20	CPP-25	CPP-26	CPP-27	CPP-28	CPP-31	CPP-32 (E)	CPP-33	CPP-58 (E)	CPP-58 (W)	CPP-79
Chloromethane	X	—	—	X	—	—	—	X	X	—	—	X
Cyclohexane	X	—	—	—	—	—	—	—	X	—	—	—
Cyclohexanone	X	—	—	—	—	—	—	—	X	—	—	—
2,4-dinitrophenol	X	—	—	—	—	—	—	—	X	—	—	—
Ethyl acetate	X	—	—	—	—	—	—	—	X	—	—	—
Ethyl benzene	X	—	—	X	—	—	—	X	X	—	—	X
2-hexanone	X	—	—	X	—	—	—	X	X	—	—	X
Methanol	X	—	—	—	—	—	—	—	X	—	—	—
Methylene chloride	X	—	—	X	—	—	—	X	X	—	—	X
Methyl ethyl ketone	X	—	—		—	—	—		X	—	—	—
Methyl isobutyl ketone	X	—	—	—	—	—	—	—	X	—	—	—
N-nitrosodimethylamine	X	—	—	—	—	—	—	—	X	—	—	—
Polychlorinated biphenyl (Aroclor 1260)	—	—	—	—	—	—	—	—	X	—	—	—
Pyridine	—	—	—	—	—	—	—	—	X	—	—	—
Tetrachloroethylene	X	—	—	X	—	—	—	X	X	—	—	X
Toluene	X	—	—	X	—	—	—	X	X	—	—	X
1,1,1-trichloroethane	X	—	—	X	—	—	—	X	X	—	—	X
Trichloroethylene	X	—	—	X	—	—	—	X	X	—	—	X
Xylene	X	—	—	X	—	—	—	X	X	—	—	X

a. Indicates the specific analyte has not been sampled for at the specific site.

Table 2-3. Evaluation of radiological and nonradiological contaminants previously identified in the WAG 3 OU 3-14 tank farm.

Material or Chemical (CAS #, Vapor Density & Ionization Energy)	Exposure Limit[a] (PEL/TLV)	Routes of Exposure[b]	Indicators or Symptoms of Overexposure[c] (Acute and Chronic)	Target Organs/System	Carcinogen? (source)[d]	Exposure Potential (all routes without regard to PPE)
Nonradiological Contaminants						
Arsenic (7440-38-2) VP: NA	TLV-TWA: 0.010 mg/m^3	Ih, Ig, S, Con	Ulceration of nasal septum, dermatitis, GI disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin.	Liver, kidneys, skin, lungs, lymphatic system	A1 - ACGIH	Low potential. Highest concentration of 6.8 mg/kg in the 50 samples analyzed is slightly above background. The closed vacuum extraction system will mitigate airborne dust. Greatest potential during drummed soil sampling.
Beryllium (7440-41-7) VD = NA	TLV: 0.002 mg/m^3 STEL: 0.01 mg/m^3	Ih, Con	Berylliosis; anorexia, weight loss, weakness, chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency; irritation eyes; dermatitis.	Eyes, skin, respiratory system	Yes-NTP Yes-IARC No-OSHA	Content codes 001 and 002, solid
Cadmium (7440-43-9) VD = NA	TLV: 0.01 mg/m^3 Respirable: 0.002 mg/m^3 PEL: 5 μg/m^3 Action level: 2.5 μg/m^3 (29 CFR 1926.1127)	Ih, Ig	Pulmonary edema, dyspnea, cough, chest tightness, substernal pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia, emphysema, proteinuria, mild anemia.	Respiratory system, kidneys, prostate, blood	Yes-NTP Yes-IARC A2-ACGIH Yes-OSHA	Content codes 001 and 002, solid
Lead (7439-92-1) VD = NA	TLV: 50 μg/m^3 OR A PEL in μg/m^3 equal to 400 divided by the number of hours worked per day for shifts longer than 8 hours. (29 CFR 1926.62)	Ih, Ig, Con	Weakness, lassitude, insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypotension.	Eyes, GI, CNS, kidneys, blood, gingival tissue	No	Content code (unknown), solid.

Table 2-3. (continued).

Material or Chemical (CAS #, Vapor Density & Ionization Energy)	Exposure Limit[a] (PEL/TLV)	Routes of Exposure[b]	Indicators or Symptoms of Overexposure[c] (Acute and Chronic)	Target Organs/System	Carcinogen? (source)[d]	Exposure Potential (all routes without regard to PPE)
Mercury compounds (7439-97-6) VP: 0.0012 mmHg	TLV-TWA: 0.025 mg/m^3 (as inorganic Hg) C- 0.1 mg/m^3	Ih, Ig, S, Con	Inhalation of vapors may cause pneumonitis. Extremely destructive to mucus membrane, upper respiratory tract, eyes, and skin. Burning sensation, coughing, wheezing, laryngitis, short breath, headache, nausea, vomiting.	CNS, vision, kidney, skin, respiratory system	No	Low–moderate potential. Highest concentration 4.44 mg/kg with average of 3.03×10^{-1} mg/kg in 95 samples. The closed vacuum extraction system will mitigate airborne dust. Greatest potential during drummed soil sampling and sample equipment decontamination.
Thallium (7440-28-0) VP: NA	TLV-TWA: 0.1 mg/m^3	Ih, S, Ig, Con	Nausea, diarrhea, abdominal pain, vomiting, chest pain, pulmonary edema, seizure, liver or kidney damage.	Eyes, skin, respiratory system, CNS, liver, kidneys, GI tract, body hair	No	Low potential. Highest concentration of 4.85 mg/kg in the 16 samples analyzed. The closed vacuum extraction system will mitigate airborne dust. Greatest potential during drummed soil sampling.
Zirconium (7440-67-7) VP: NA	TLV-TWA: 5 mg/m^3	Ih, Con	Skin, lung granulomas, retention in lungs, skin irritation and irritation of the mucous membranes.	Skin, respiratory system	No	Low potential. Highest concentration 1.40×10^1 mg/kg with average of 8.61 mg/kg in five samples analyzed. Greatest potential during drummed soil sampling.
Nitric Acid 7697-37-2 IE - 11.95 eV	TLV—2 ppm STEL—4 ppm	Ih, Ig, Con	Irritation eyes, skin, mucous membrane; delayed pulmonary edema, pneumonitis, bronchitis; dental erosion.	Eyes, skin, respiratory system, teeth	No	Low–moderate potential. Used to preserve QA/QC rinsate samples for metals analysis.
Diesel fuel (68476-34-6) VD = 1.0 IE = NA	TLV: 100 mg/m^3 (ACGIH—diesel fuel vapor or aerosol)	Ih, Ig, S, Con	Eye irritation; respiratory system changes; dermatitis.	Eye, respiratory system	No	Fuel handling during refueling of excavator and other diesel powered equipment.

Table 2-3. (continued).

Material or Chemical (CAS #, Vapor Density & Ionization Energy)	Exposure Limit[a] (PEL/TLV)	Routes of Exposure[b]	Indicators or Symptoms of Overexposure[c] (Acute and Chronic)	Target Organs/System	Carcinogen? (source)[d]	Exposure Potential (all routes without regard to PPE)
Diesel exhaust (particulate aerodynamic diameter <1 μm)	TLV: 0.02 mg/m^3 (ACGIH 2002)	Ih	Respiratory, nose, throat or lung irritation with stinging and redness of the eyes; headache; nausea; dizziness; unconsciousness.	Respiratory system	A2—ACGIH	Exhaust from excavator and other diesel-powered equipment.
Radionuclides Detected— Am-241, Ce-144, Co-60, Cs-134, Cs-137, Eu-154, H-3, Np-237, Pu-238, Pu-239/240, Pu-241, Pu-242, Ru-106, Sr-90, Tc-99, U-234, U-235, U-236, and U-238 (DOE-ID [1999])						
Radiological Contaminants						
Radionuclides (radiation fields)	ALARA, dose limit, in accordance with RWP. Posting of radiation areas in accordance with PRD-183. Thermoluminescent dosimeters will be used to measure whole body TEDE.	Whole body	Alarming dosimeters will be used to alert workers to increased gamma radiation fields on a real time basis. TLDs will be used to monitor whole body exposure but do not provide real time information. Radiation surveys performed by the RadCon organization during work activities will also provide indication of overexposure.	Blood-forming cells, GI tract, and rapidly dividing cells	Yes—IARC	Moderate–high potential. Primary exposure potential from working in close proximity to contaminated soil with contact exposure rates > 5 mR/hour , and handling soil during sampling and containerization tasks.
Radionuclides (fixed and removable surface contamination)	ALARA, dose limit, in accordance with RWP. Posting of contamination areas in accordance with PRD-183.	Ih, Ig, broken skin	Alarming CAMs, high counts on portable air samplers, direct-reading instruments, swipe counter (scaler), and alarm indication on personal contamination monitors.	GI tract, ionization of internal tissue through uptake of radionuclides	Yes—IARC	Moderate potential. Contact with contaminated soil and surfaces. Greatest potential during drummed soil sampling and vacuum extraction operations (drum change-out).

Table 2-3. (continued).

Material or Chemical (CAS #, Vapor Density & Ionization Energy)	Exposure Limit[a] (PEL/TLV)	Routes of Exposure[b]	Indicators or Symptoms of Overexposure[c] (Acute and Chronic)	Target Organs/System	Carcinogen? (source)[d]	Exposure Potential (all routes without regard to PPE)
Radionuclides (airborne radioactivity)	ALARA, dose limit, in accordance with RWP. Posting of airborne radioactivity areas in accordance with PRD-183.	Ih, Ig, broken skin	Alarming CAMs, high counts on portable air samplers and personal air samplers.	GI tract, ionization of internal tissue through uptake of radionuclides	Yes- IARC	Moderate potential. Release of dust or dust generation during soil vacuum excavation activities.

a. American Conference of Governmental Industrial Hygienists (ACGIH) 2001 TLV Booklet and OSHA, 29 CFR 1910, substance-specific standards.

b. (Ih) inhalation; (Ig) ingestion; (S) skin absorption; (Con) contact hazard.

c. (Nervous system) dizziness/nausea/lightheadedness; (dermis) rashes/itching/redness; (respiratory) respiratory effects; (eyes) tearing/irritation.

d. If yes, identify agency and appropriate designation (ACGIH A1 or A2, NIOSH, OSHA, IARC, NTP).

CNS = central nervous system	CVS = cardiovascular system	GI = gastrointestinal
IE = ionization energy	eV = electron volts	PEL = permissible exposure limit
RCM = Radiological Control Manual	REM = roentgen equivalent man	STEL = short-term exposure limit
TLV = threshold-limit value	VD = vapor density (Air = 1)	c = ceiling limit
TLD = thermoluminescent dosimeter	TWA = threshold weighted average	IARC = International Agency on Research of Carcinogens
NTP = National Toxicology Program	VP = vapor pressure	ACGIH = American Conference of Governmental Industrial Hygienists
ppb = parts per billion	NA = not applicable	VD = vapor density
TEDE = total effective dose equivalent	CAM = continuous air monitor	ALARA = as low as reasonably achievable

Table 2-4. Phase I and Phase II tank farm soil and groundwater OU 3-14 RI/FS tasks, associated hazards, and mitigation.

Task(s)	Potential Hazard or Hazardous Agent	Hazard Elimination, Isolation, or Mitigation
Sampling area site preparation Drilling Logging Core/soil sampling Sampling equipment decontamination	1. External radiation exposure—close proximity of contaminated soil/equipment surfaces and potential shine from installed probeholes	1. Controlled work areas, RWP, RCT surveys with direct-reading instruments, alarming electronic dosimetry, postings, and training
	2. Radiological contamination—potential contact with radionuclide contaminated soil and equipment during investigation and sampling activities and decontamination tasks	2. Controlled work areas, RWP, RCT surveys with direct-reading instruments, swipes, postings, training, personal contamination monitor (PCM), including air sampling and CAMs, if applicable, and PPE (as required)
	3. Nonradiological contamination—potential contact with contaminated soil/equipment surfaces during investigation, sampling activities, fuel, dusts, and decontamination tasks	3. Controlled work areas, MSDSs for all chemicals used, engineering controls for dust suppression, IH monitoring with direct-reading instruments, postings, and PPE (as required)
	4. Pinch points/caught-between/struck-by—drill rig operations, logging cables/sheaves/tripod, sampling, vehicle/equipment movement, material handling	4. Experienced samplers, qualified drill operators/helpers, spotter, backup alarms, controlled work areas, safe work permit (SWP), body position awareness, and hand and head/face protection
	5. Lifting/back strain—moving drill steel, core/sample logging, handling sample coolers	5. Drill steel rack/tray/storage vehicle, mechanical lifting/movement, proper lifting techniques, two-person lift for full coolers (as required)
	6. Heat/cold stress—outdoor work, summer/fall temperatures, PPE usage, combined with strenuous workload	6. IH monitoring, work-rest or warm-up cycles (as required), stay times on SWP (as required), proper selection of work clothing/PPE, fluids available in eating/drinking area, personnel training
	7. Hazards noise levels—drill rig, heavy equipment, and hand tools	7. IH sound level monitoring and/or dosimetry, source identification, and hearing protection devices (as required)
	8. Stored energy—Mechanical/thermal, elevated materials	8. Controlled work area, training, isolation of energy source (lockout/tagout [LO/TO]) for all maintenance activities (as required)

Table 2-5. Phase I and Phase II tank farm soil and groundwater OU 3-14 RI/FS radiological and nonradiological hazards to be monitored.[a]

Tasks	Radiological and Nonradiological Hazards to be Monitored
Sampling area site preparation	Radionuclide contamination (alpha, beta, and gamma) – drilling, logging, and soil sampling tasks; sample equipment decontamination, as deemed appropriate by INTEC RadCon.
Drilling	External radiation exposure – probe installation, soil sampling, logging activities.
Logging	Airborne radioactivity – vacuum excavation, soil sampling, decontamination.
Core/soil sampling	Hazards noise – drilling, vacuum system operations, hand tools, generators, and air compressors.
Sampling equipment decontamination	Mercury vapor – soil sampling and sampling equipment decontamination as deemed appropriate by project IH.
	Arsenic, thallium, zirconium (dust)[b] - All soil activities with identified potential for airborne dust are identified and as deemed appropriate by project IH.
	Particulates not otherwise classified (PNOC) – All soil disturbance tasks have potential to generate dust. Sampling to be conducted as deemed appropriate by project IH based on site-specific conditions and proximity of personnel to dust-generating task(s) for total and respirable fractions.

a. Monitoring and sampling will be conducted as deemed appropriate by project IH and RadCon personnel based on specific tasks and site conditions.

b. Sampling media, methods, and use of cyclones or other particle aerodynamic sizing devices will be based on site-specific conditions and as deemed appropriate by the project IH.

Table 2-6. Equipment available for monitoring radiological and nonradiological hazards.[a]

Chemical or Radiological Hazard to be Monitored or Sampled	Equipment and Monitoring/Sampling Method[b]	
Particulates not otherwise classified (PNOC), arsenic, thallium, and zirconium dust	Personal sampling pumps with appropriate media for all partial and full period sampling	PNOC (total and respirable)—NIOSH 0600 Arsenic—NIOSH 7300, 7900 Thallium—NIOSH 7300 Zirconium—NIOSH 7300
Mercury vapor	Jerome mercury vapor analyzer (or equivalent)	
Radionuclide contamination (alpha)	Count-rate—Bicron/NE Electra (DP-6 or AP-5 probe) or equivalent Stationary—Eberline RO-20 or RO-7 (2, 200, 20k probes) or equivalent CAM—ALPHA 6-A-1 (in-line and radial sample heads, pump, RS-485) or equivalent (as required) Grab Sampler—SAIC H-810 or equivalent	
Radionuclide contamination (beta/gamma)	Count-rate—Bicron NE/Electra (DP-6, BP-17 probes) or equivalent Stationary— Eberline RO-20 or RO-7 (2, 200, 20k probes) or equivalent CAM (beta)—AMS-4 (in-line and radial head, pump RS-485) or equivalent (as required) Grab Sampler—SAIC H-810 or equivalent	
Radionuclide contamination (general counting)	LB-5100/NFS-RPS Counting System or equivalent Alpha/Beta Scalars Protean or equivalent	
Personal contamination monitors	Eberline PCM-2 or PCM-1C or equivalent	
Radiation (gamma and neutron) fields and Geiger-Mueller (GM) instruments	Ion Chamber—Eberline RO-20 with RO-7 (2, 200, and 20K probes) or equivalent GM Dose Rate—Ludlum 2241 (HP-270 probe) or equivalent Electronic dosimetry—SAIC PD-3I with reader and RCMIS station or equivalent	
Hazardous noise levels (>85 dBA for an 8-hour workday, 83 dBA for a 10 hour day, >140 impact)	ANSI Type S2A sound level meter and/or ANSI S1.25-1991 dosimeter (A-weighted scale for TWA dosimetry, C-weighted for impact dominant sound environments)	
Heat/cold stress	Heat Stress—WBGT, body weight, fluid intake	Cold Stress—ambient air temperature, wind chill charts

a. Air sampling will be conducted as deemed appropriate by project IH and RadCon personnel based on initial direct-reading instrument data, swipes, and other site-specific factors.

b. Equivalent validated air sampling method may be selected if more appropriate for site-specific conditions.

VOC = volatile organic compound
TWA = time-weighted average
PCM = personal contamination monitor
CAM = continuous air monitor
dBA = decibel A-weighted
ANSI = American National Standards Institute
WBGT = wet bulb globe temperature
NIOSH = National Institute of Occupational Safety and Health

Table 2-7. Action levels and associated responses for Phase I and Phase II tank farm soil and groundwater OU 3-14 RI/FS hazards.

Contaminant/Agent Monitored	Action Level	Response Taken if Action Levels Exceeded
Nuisance particulates (NOC)	>10 mg/m^3 (inhalable fraction) >3 mg/m^3 (respirable fraction)	1. Move personnel to upwind position of source. 2. Use wetting/misting methods to minimize dust and particulate matter. 3. If wetting/misting methods prove ineffective, don respiratory protection[a] (as directed by IH).
Mercury vapor	0.01 – 0.025 mg/m^3 sustained in work area	Continue to monitor area and check worker's breathing zone.
	>0.025 sustained for 1 min in workers' breathing zone	If episodic—Leave area until vapor dissipates, continuously monitor or don minimum Level C respiratory protection and continue working. If sustained—Don minimum Level C respiratory protection.[a]
Hazardous noise levels	<85 dBA 8-hour TWA, <83 dBA 10-hour TWA	No action.
	85–114 dBA	Hearing protection required to attenuate to below 85 dBA 8-hour TWA or 83 dBA for 10-hour TWA (noise reduction rating).
	(a) >115 dBA (b) >140 dBA	(a) Isolate source, evaluate NRR for single device, double protection as needed. (b) Control entry, isolate source, only approved double protection worn.
Radiation field	<5 mrem/hr	No action, no posting required.
	5–100 mrem/hr @ 30 cm (10 CFR 835.2)	Post as "Radiation Area"—Required items: RW I or II training, RWP, personal dosimetry.
	>100 mrem–500 Rad @ 100 cm (10 CFR 835.2)	Post as "High Radiation Area"—Required items: RW II, RWP, alarming personal dosimetry, dose rate meter, and temporary shielding (as required).
Radionuclide contamination	1-100 times RCM Table 2-2 values (PRD-183, Article 234)	Post as "Contamination Area"—Required items: RW II training, personal dosimetry, RWP, don PPE, bioassay submittal (as required).
	>100 times RCM Table 2-2 values (PRD-183, Article 234)	Post as "High Contamination Area"—Required items: RW II training, personal dosimetry, RWP (with prejob briefing), don PPE, bioassay submittal (as required).

Table 2-7. (continued).

Contaminant/Agent Monitored	Action Level	Response Taken if Action Levels Exceeded
Airborne radioactivity	Concentrations (μCi/cc) >30% of DAC value (10 CFR 835.603(d))	Post as "Airborne Radioactivity Area"—Required items: RW II training, personal dosimetry, RWP (with prejob briefing), don PPE, bioassay submittal (as required).

a. Level C respiratory protection for mercury will consist of a full-face respirator equipped with an MSA Mersorb® cartridge with end-of-service-life indicator (or equivalent) as prescribed by the project IH. A high-efficiency particulate air (HEPA) cartridge will be worn for airborne particulates. See Section 5, Personal Protective Equipment, for additional Level C requirements.

CAM = continuous air monitor
DAC = derived air concentration
dBA = decibel A-weighted
NRR = Noise reduction rating
RW = Radiological Worker
RCM = Radiological Control Manual
TWA = time-weighted average

2.2 Routes of Exposure

Exposure pathways for contaminants that may be encountered during OU 3-14 tank farm work are directly related to the nature of tasks, type of equipment used, and effectiveness of project controls (e.g., engineering controls and avoiding contact with contaminated material). Isolation methods (e.g., the soil vacuum extraction system), IH and RadCon monitoring, training, and work controls are all intended to mitigate potential exposures and uptake of contaminants. However, the potential for exposure still exists.

Exposure pathways include

- Inhalation of contaminated soil fugitive dust. Inhalable or respirable (depending on the particle aerodynamic diameter) fugitive dust may have trace amounts of contaminants or radionuclides and could result in a respiratory tract deposition.

- During soil sampling tasks, skin absorption and contact with surface contamination which may be absorbed through unprotected skin

- Ingestion of contaminated soil or materials adsorbed to dust particles or on surfaces resulting in potential uptake of contaminants through the gastrointestinal tract that may result in gastrointestinal irritation, internal tissue irradiation, or deposition to target organs

- Injection while handling contaminated materials by breaking of the skin or migration through an existing wound, resulting in localized irritation, contamination, uptake of soluble contaminants, and deposition of insoluble contaminants.

2.3 Environmental and Personnel Monitoring

The greatest potential for exposure to contaminants during OU 3-14 RI/FS activities is from contact with contaminated soil during soil vacuuming and subsequent sampling tasks. The HEPA-filtered vacuum extraction system, in combination with work control zones (Section 7), engineering and administrative controls, worker training and procedures, and use of protective equipment, will mitigate exposure potential to the degree possible.

RadCon and IH personnel will focus on soil vacuuming and sampling activities and monitoring with direct-reading instruments, collect swipes, and conduct full and partial period air sampling in accordance with applicable MCPs and other applicable guidelines. Monitoring with direct-reading instruments will be used to assess the effectiveness of controls and work practices. Monitoring will be site-specific with instrumentation listed on Table 2-6, selected on the basis of the conditions and contaminants associated with each task or location. The RCT and IH will be responsible for determining the best monitoring technique for radiological and nonradiological contaminants, respectively. Other support personnel (e.g., equipment operators, drillers) and the general work area may also be monitored to verify the integrity of engineering controls and to determine the effectiveness of contamination control and decontamination practices, if required.

Personnel working at the Phase I and Phase II tank farm soil and groundwater OU 3-14 RI/FS site may be exposed to hazardous materials or hazardous physical agents. Safety hazards and other physical hazards will be monitored and controlled as outlined in Section 2.4. Specific hazardous agent exposures that will be monitored are listed in Table 2-5. The IH and radiological monitoring are outlined in Sections 2.3.1 and 2.3.2, respectively.

2.3.1 Industrial Hygiene Monitoring

Various direct-reading instruments and other semiquantitative detection tests may be used to determine the presence of nonradiological and other physical agents. The frequency and type of sampling and monitoring will be determined by changing site conditions, direct-reading instrument results, observation, and professional judgment. Instruments and sampling methods listed in Table 2-6 are available for use by the project IH.

Based on direct-reading instruments and changing site conditions, the IH may conduct full- and partial-period airborne contaminant sampling. All air sampling will be done using applicable NIOSH or OSHA methods and in conformance with the BBWI safety and health manuals. Risk assessments for site personnel will be conducted according to the MCP-153, "Industrial Hygiene Exposure Assessment."

2.3.1.1 Industrial Hygiene Instrument and Equipment Calibration. All monitoring instruments will be maintained and calibrated in accordance with the manufacturer's recommendations, in accordance with existing IH protocol, and in conformance with the TPR-6324, "Calibration of Industrial Hygiene Measuring and Test Equipment." At a minimum, direct-reading instruments will be calibrated or function-tested prior to daily use or more frequently as determined by the project IH calibration/function-testing information. Calibration information, sampling and monitoring data, results from direct-reading instruments, and field observations will be recorded as stated in Section 3.

2.3.2 Radiological Monitoring

Radiological contamination could be encountered during OU 3-14 remedial investigation activities. This potential exposure includes external radiation (penetrating ionizing radiation [gamma and high-energy beta]) and internal radiation (inhalable, ingestible, or absorbed radioactive contaminants) during these tasks. For purposes of this monitoring section, radiation (external) and contamination (internal) will be discussed separately and distinguished on the basis of their primary effects. Monitoring will be performed in accordance with the INEEL Radiological Control Manual (PRD-183) and associated procedures. The project RCT may use instruments and sampling methods listed in Tables 2-6 and 2-7. Monitoring will be performed in accordance with MCP-139, "Radiological Surveys"; MCP-425, "Radiological Release Surveys and the Control and Movement of Contaminated Materials"; and MCP-357, "Job-Specific Air Sampling/Monitoring."

2.3.2.1 Radiation Monitoring. The primary source of external radiation hazards during this project will be from contact with or proximity to contaminated soil or contaminated equipment.

RadCon personnel will use direct-reading radiation detectors (for example, ion chambers, Geiger-Mueller [GM]), thermoluminescent dosimeters (TLDs), and electronic dosimetry to measure and evaluate radiation exposures. The collected radiological data will be used to evaluate the effectiveness of engineering controls, ensure adequacy of work zone boundaries, alert project personnel to potential unexpected elevated radiation sources, and ensure the effectiveness of material handling methods and procedures.

2.3.2.2 Contamination Monitoring. The primary sources of contamination will be soil vacuum extraction operations (drum changeout), drummed soil sampling activities, and equipment decontamination. The closed HEPA-filtered vacuum system, standardized sampling techniques, placement of barrier material (e.g., plastic sheeting) where feasible, and protective clothing will minimize the contamination hazard.

Direct frisk and surveys for removable contamination will be used to monitor for alpha and beta-gamma contamination. Low background alpha-beta counters may also be used to quantify contamination levels. RadCon personnel will use contamination monitoring data to evaluate the effectiveness of engineering controls, ensure adequacy of radiological area boundaries, alert project personnel to avoid contaminated areas, and ensure the effectiveness of personnel and equipment decontamination procedures.

2.3.2.3 Radiological Instrument and Equipment Calibration. RadCon personnel may use any of the health physics instruments listed in Table 2-6 to provide radiological information to project personnel. Accountable radioactive sources will be maintained in accordance with MCP-137, "Radioactive Source Accountability and Control." All radiological survey and monitoring equipment will be maintained and calibrated in accordance with the manufacturer's recommendations and in conformance with MCP-93, "Health Physics Instrumentation."

2.3.2.4 Internal Monitoring. The purpose of internal dose monitoring is to demonstrate the effectiveness of contamination control practices and to document the nature and extent of any internal uptakes, as specified in MCP-191. Internal deposition of contamination or airborne radioactivity presents a potential for exposure during soil remedial investigation and sampling tasks. If required, whole body counts or bioassay will be determined by the project radiological engineer and specified on the RWP. Project personnel are responsible for submitting all required bioassay samples on request.

2.3.2.5 External Dosimetry. Dosimetry for personnel conducting Phase I and Phase II INTEC tank farm soil and groundwater OU 3-14 RI/FS tasks will be specified in the task-specific RWP. All project personnel will wear personal dosimetry devices in accordance with PRD-183 and as directed by INTEC RadCon personnel.

2.3.3 Exposure Action Limits

Action levels have been established for hazards and contaminants that may be encountered during Phase I and Phase II tank farm soil and groundwater OU 3-14 tasks to prevent and mitigate potential personnel exposure to radiological, nonradiological, and physical hazards. The project IH and RCT will evaluate investigation and sampling tasks using real-time monitoring as described in Section 2.3 based on the site-specific conditions.

Specific action levels will only apply if the hazard or contaminant listed on Table 2-7 is encountered. If action levels are reached, personnel will take the appropriate actions as listed. For PPE upgrades, the threshold for the particular level of PPE currently being worn must be exceeded or another type of contaminant introduced that will require modifications (i.e., Level C full-face ensemble offers a respiratory protection factor of 100 [nonradiological contaminants], so no further upgrade would be required if airborne contaminants were detected unless the protection factor is exceeded). For sustained airborne contaminants, full- or partial-period air samples will be collected to quantify the contaminant of concern.

2.4 Physical Hazards Evaluation, Control, and Monitoring

The physical hazards present during Phase I and Phase II tank farm soil and groundwater OU 3-14 RI/FS tasks and the methods that will be used to monitor and control them are described in this section. It is critical that all personnel are aware of and understand the nature of the tasks, the equipment to be used, and the controls in place to eliminate or mitigate potential safety hazards.

2.4.1 Temperature Extremes

Project activities will be conducted during months when both heat and cold stress factors could affect work-site personnel based on ambient air temperatures and layered PPE.

2.4.1.1 Heat Stress. During investigation and sampling tasks, temperatures will be variable and personnel may be required to wear protective clothing that prevents the body from cooling. High ambient air temperatures can result in increased body temperature, heat fatigue, heat exhaustion, or heat stroke that can lead to symptoms ranging from physical discomfort to unconsciousness and death. Personnel must inform the FTL or HSO when experiencing any signs or symptoms of heat stress or observing a fellow employee ("buddy") experiencing them. MCP-2704, "Heat and Cold Stress," and Table 2-8 describe heat stress hazards, signs, and symptoms of exposure. Heat stress stay times will be documented on the prejob briefing or SWP by the project HSO in consultation with the project IH. These stay times will take into account the nature of the work (e.g., light, moderate, heavy), the type of PPE worn, and the ambient work temperatures.

Table 2-8. Heat stress signs and symptoms.

Heat-Related Illness	Signs and Symptoms	Emergency Care
Heat rash	Red skin rash and reduced sweating	Keep the skin clean, change all clothing daily, cover affected areas with powder containing cornstarch or with plain cornstarch.
Heat cramps	Severe muscle cramps, exhaustion, sometimes with dizziness or periods of faintness	Move the patient to a nearby cool place; give the patient half-strength electrolytic fluids; if cramps persist or if more serious signs develop, seek medical attention.
Heat exhaustion	Rapid, shallow breathing; weak pulse; cold, clammy skin; heavy perspiration; total body weakness; dizziness that sometimes leads to unconsciousness	Move the patient to a nearby cool place; keep the patient at rest; give the patient half-strength electrolytic fluids; treat for shock; seek medical attention. DO NOT TRY TO ADMINISTER FLUIDS TO AN UNCONSCIOUS PATIENT.
Heat stroke	Deep, then shallow, breathing; rapid, strong pulse, then rapid, weak pulse; dry, hot skin; dilated pupils; loss of consciousness (possible coma); seizures or muscular twitching	Cool the patient rapidly. Treat for shock. If cold-packs or ice bags are available, wrap them and place one bag or pack under each armpit, behind each knee, one in the groin, one on each wrist and ankle, and one on each side of the neck. Seek medical attention as rapidly as possible. Monitor the patient's vital signs constantly. DO NOT ADMINISTER FLUIDS OF ANY KIND.

Heat exhaustion and heat stroke are extremely serious conditions that can cause death. An individual showing any of the symptoms of heat exhaustion listed in Table 2-8 will do or be subject to the following:

- Stop work
- Exit or be helped from the work area
- Remove or decontaminate protective clothing (as applicable)
- Move to sheltered area to rest
- Be provided cool drinking water
- Be monitored by a medic or employee certified in CPR and first-aid.

Monitoring for heat stress conditions will be performed in accordance with MCP-2704, "Heat and Cold Stress." Depending on the ambient weather conditions, work conditions, type of PPE worn, and the physical response of work operations personnel, the IH will inform the FTL or RCT of necessary adjustments to the work/rest cycle. Additionally, physiological monitoring may be conducted to determine if personnel are replenishing liquids fast enough. A supply of cool drinking water should be provided in designated eating areas and consumed only in these areas. Workers may periodically be interviewed by the IH, RCT, or HSO to ensure that the controls are effective and that excessive heat exposure is not occurring. Workers will be encouraged to monitor their body signs and to take breaks if symptoms of heat stress occur.

2.4.1.2 Low Temperatures. Exposure to low temperatures will only be a factor if project tasks are delayed until the fall months or relatively cool ambient temperatures and wet or windy conditions are experienced. The project IH and HSO will be responsible for obtaining meteorological information to determine if additional cold stress administrative controls are required. MCP-2704, "Heat and Cold Stress," discusses the hazards and monitoring of cold stress. Table 2-9 provides the cold stress work/warm-up schedule if cold stress conditions exist (late fall, winter, early spring). Project personnel will also be cautioned regarding cold stress factors associated with rapid cooling once impermeable PPE layers are removed causing the potential for freezing of accumulated moisture on PPE outer and inner surfaces (under extremely cold conditions). Section 9 describes the requirements for the outer layer of protection based on radiological and nonradiological hazards.

Additional cold weather hazards may exist from working on snow- or ice-covered surfaces. Slip, fall, and material handling hazards are increased under these conditions. Every effort must be made to ensure walking surfaces are kept clear of ice. The FTL or HSO should be notified immediately if slip or fall hazards are noted at the project site.

Table 2-9. Cold stress work/warm-up schedule (for winter season).

	No Noticeable Wind		5-mph Wind		10-mph Wind		15-mph Wind		20-mph Wind	
Air Temp °F (approx.)	Max Work Period	No. of Breaks	Max Work Period	No. of Breaks	Max Work Period	No. of Breaks	Max Work Period	No. of Breaks	Max Work Period	No. of Breaks
-15° to -19°	Normal breaks	1	Normal breaks	1	75 min	2	55 min	3	40 min	4
-20° to -24°	Normal breaks	1	75 min	2	55 min	3	40 min	4	30 min	5
-25° to -29°	75 min	2	55 min	3	40 min	4	30 min	5	Nonemergency work should cease	
-30° to -34°	55 min	3	40 min	4	30 min	5	Nonemergency work should cease			
-35° to -39°	40 min	4	30 min	5	Nonemergency work should cease					
-40° to -44°	30 min	5	Nonemergency work should cease							
-45° and below	Nonemergency work should cease									

2.4.2 Ultraviolet Light Exposure

Personnel exposed to ultraviolet (UV) light (i.e., sunlight) while conducting project tasks are reminded to protect themselves from sunlight. Sunlight is the main source of UV known to damage the skin and potentially cause skin cancer. The amount of UV exposure depends on the strength of the light, the length of exposure, and whether the skin is protected. Since UV rays or suntans are unsafe, the following mitigative actions are recommended to minimize UV exposure:

- Wear clothing to cover the skin (long pants [no shorts] and long-sleeve or short-sleeve shirt [no tank tops])
- Use a sunscreen with a minimum sun protection factor (SPF) of 15
- Wear a hat (hard hat where required)
- Wear UV-absorbing safety glasses
- Limit exposure during peak intensity hours of 10 a.m. to 4 p.m. whenever possible.

2.4.3 Noise

Personnel involved in drilling and sampling activities may be exposed to noise levels from the drill rig, hand tools, and compressors may that exceed 85 decibels A-weighted (dBA) for an 8-hour time-weighted average (TWA) or 83 dBA for 10-hour TWA. The effects of high sound levels (noise) may include the following:

- Personnel being startled, distracted, or fatigued
- Physical damage to the ear, pain, and temporary or permanent hearing loss
- Interference with communication that would warn of danger.

The IH will measure noise using instruments listed in Table 2-6. Noise measurements will be performed in accordance with MCP-2719, "Controlling and Monitoring Exposure to Noise," to determine if personnel assigned to the jobs identified are above allowable noise exposure levels. A TLV of 85 dBA TWA will be applied to personnel exposed to noise levels over no more than an 8-hour day. This level is based on a 16-hour "recovery" period in a low noise environment. If personnel are required to work longer than 8 hours in a hazardous noise environment, then the TLV will be adjusted to a lower value. The project IH must be consulted regarding modifications to the 85 dBA for an 8-hour TLV and 83 dBA for a 10-hour TWA value.

Personnel whose noise meets or exceeds the allowable level will be enrolled in the INEEL Occupation Medical Program (OMP) or appropriate subcontractor hearing conservation program. Personnel working on jobs that have noise exposures greater than 85 dBA (83 dBA for a 10-hour TWA) will be required to wear hearing protection until noise levels have been evaluated and will continue to wear the hearing protection specified by the IH until directed otherwise.

2.4.4 Fire and Flammable Materials Hazards

Flammable and combustible material hazards may include combustible materials near ignition sources (hot motor or exhaust system) and transfer and storage of flammable or combustible liquids in the support zone (SZ) (fueling the drill rig and support equipment). Portable fire extinguishers with a minimum rating of 10A/60BC will be strategically located at the project site to combat Class ABC fires. They will be located in the exclusion zone (EZ), on or near all site equipment that has exhaust heat sources, and on or near all equipment capable of generating ignition or sparking. A sufficient number of field team members will receive fire extinguisher training as discussed in Section 6 (Table 6-1).

2.4.4.1 Project Equipment Fire Hazards. Combustible or ignitable materials in contact with or near exhaust manifolds, catalytic converters, or other ignition sources could result in a fire. The INTEC fire protection engineer should be contacted if questions arise regarding potential ignition sources. The accumulation of combustible materials will be strictly controlled at the project site. Disposal of combustible materials will be assessed at the end of each shift. Class A combustibles such as trash, cardboard, rags, wood, and plastic will be properly disposed of in metal receptacles in the SZ and in appropriate waste containers within the contamination reduction corridor (CRC), contamination reduction zone (CRZ), and EZ.

Diesel fuel that may be used at the work site for fueling must be safely stored, handled, and used. Only Factory Mutual/Underwriters Laboratories (FM/UL) -approved flammable liquid containers labeled with the content will be used to store fuel. All fuel containers will be stored at least 15 m (50 ft) from any facilities and ignition sources or inside an approved flammable storage cabinet. Additional requirements are provided in PRD-308, "Handling and Use of Flammable and Combustible Liquids." Portable motorized equipment (e.g., generators and light plants) will be shut off and allowed to cool down in accordance with the manufacturer's operating instructions prior to refueling to minimize the potential for a fuel fire.

2.4.5 Biological Hazards

The OU 3-14 tank farm soil and groundwater remedial investigation tasks will be conducted in areas at INTEC where there is a potential for encountering significant nesting materials. The facility is located in an area that provides habitat for various rodents, insects, and reptiles. Biological studies at the INEEL have shown that local deer mice can carry the hantavirus. The virus is in the nesting and fecal matter of deer mice. Project personnel could disturb nesting or fecal matter during investigation and sampling activities. If such materials are disturbed, they can become airborne and create a potential inhalation pathway for the virus. Contact with and improper removal of these materials may increase inhalation exposure risks.

If suspected rodent nesting material or excrement is encountered, the project IH will be notified immediately and **no attempt will be made to remove the material or clean the area**. Following an evaluation of the area, an SWP will be written for disinfecting and removing material of concern from the project task area. The IH will provide the necessary guidance for protective equipment, mixing and application of the disinfecting solution (bleach solution), and proper disposal method of the waste in accordance with MCP-2750, "Preventing Hantavirus Infection."

2.4.6 Confined Spaces

Drilling and sampling tasks will not be conducted in areas that have been posted or are designated as confined spaces in accordance with MCP-2749, "Confined Spaces."

2.4.7 Safety Hazards

Industrial safety hazards pose a significant, if not the most likely, threat to personnel during investigation and sampling tasks. Section 4.2 describes general safe work practices that must be followed at all times. The following sections describe specific industrial safety hazards and procedures to eliminate or minimize potential hazards to project personnel.

2.4.7.1 Materials Handling. The most common type of materials handling accident is a finger or toe caught between two objects. Rolling stock can shift or fall from a pipe rack or truck bed. Fingers and hands can be caught between sampling barrels, breakout vises, and tools.

During probing and drilling operations, handling and maneuvering of probes, drilling cases, bits, glove bags, and various other pieces of equipment may result in employee injury. Handling drill auger flights, vacuum extraction system components, filled sample coolers, and other equipment may result in employee injury. Manual material handling will be minimized through task design and use of mechanical and hydraulic lifts whenever possible. Assistance by additional personnel may also be utilized to lift heavy or awkward objects for accident prevention.

If probeholes must be abandoned, personnel may be required to handle bags of Bentonite or sand to perform mixing operations. Bags can weigh over 36 kg (80 lb) and present a serious back strain hazard. Personnel shall not lift objects over 50 lb or 1/3 their body weight, whichever is less, without mechanical assistance or the help of another person. Personnel conducting lifting tasks will be provided training in the proper methods in accordance with PRD-2016/MCP-2739, "Material Handling, Storage, and Disposal." In addition, the Clean/Close INTEC Project HSO periodically will review the basics of safe lifting during the daily prejob briefing.

2.4.7.2 Heavy Equipment and Moving Machinery. The hazards associated with heavy equipment operation include injury to personnel, equipment damage, and property damage. All heavy equipment will be operated in the manner intended and according to manufacturer's instructions. Only authorized personnel will be allowed in the vicinity of operating heavy equipment and should maintain visual communication with the operator. Work-site personnel will comply with MCP-2745, "Heavy Industrial Vehicles"; PRD-5123, "Motor Vehicle Safety"; and 29 CFR 1910.178, "Powered Industrial Trucks."

Project personnel working around or near heavy equipment and other moving machinery will comply with the following BBWI documents:

- MCP-6501, "Hoisting and Rigging Operations"
- MCP-6502, "Hoisting and Rigging Maintenance"
- MCP-6503, "Inspection and Testing of Hoisting and Rigging Equipment"
- MCP-6504, "Hoisting and Rigging Lift Determination and Lift Plan Preparation"
- MCP-6505, "Hoisting and Rigging Training"
- DOE-STD-1090-01, Chapter 15, Construction Hoisting and Rigging Equipment Requirements, Department of Energy (DOE).

Additional safe practices include the following:

- Movement of push rod section with the catline or overhead hoist system will be limited based on wind restrictions for safe operations in accordance with PRD-600, "Maintenance Management Requirements." The HSO or designee is responsible for obtaining wind speed readings from the INEEL Warning Communications Center (WCC) or weather station. A 25-mph wind restriction will be enforced for all hoisting and rigging operations as defined by PRD-600, "Maintenance Management Requirements."
- All heavy equipment will have backup alarms.
- Walking directly in back of or to the side of heavy equipment without the operator's knowledge will be prohibited; all precautions will have been taken prior to moving heavy equipment.
- While operating heavy equipment in the work area, the equipment operator will maintain communication with a designated person responsible for providing direct voice contact or approved standard hand signals; in addition, all site personnel in the immediate work area will be made aware of the equipment operations.
- All equipment will be kept out of traffic lanes and access ways and will be stored so as not to endanger personnel at any time.

2.4.7.3 Industrial Lift Trucks. The handling and movement of filled 55-gal drums will be conducted utilizing an industrial lift truck or fork lift. It is anticipated each probe hole will generate three 55-gal drums of soil with an estimated 25 to 30 new probe hole installs. This will require the movement of approximately ninety 55-gal drums with use of mechanical equipment such as a fork lift or lift truck.

Lift truck operators shall possess a lift truck operators evidence of training prior to equipment operation. The following safe practices shall be followed by lift truck operators:

- Operator shall be familiar with the operation of the specific type of lift truck utilized.
- A lift truck pre-use inspection shall be completed and documented prior to use.

- Only equipment in proper working condition will be operated.
- Operator must remain alert at all times during lift truck operation and yield to pedestrians.
- Lift trucks shall be utilized within their rated capacities and intended use.
- The load shall be centered between the forks and as close to the fork heels as possible.
- Loads shall be moved as close to the ground as practical to maintain load stability.
- Lift truck speed shall be kept to a minimum to maintain vehicle control at all times.
- The load will be kept uphill when the slope is 10% or greater.
- Horn will be used to warn pedestrians, especially near blind corners.
- No riders will be allowed.
- Operators will be aware of overhead restrictions.
- Operators will look in the direction of travel.

2.4.7.4 Powered Equipment and Tools. All powered equipment and tools will be properly maintained and used by qualified individuals and in accordance with the manufacturer's specifications. PRD-5101, "Portable Equipment and Handheld Power Tools," will be followed for all work with powered equipment, including powered steam cleaners.

2.4.7.5 Electrical Hazards/Energized Systems. Electrical equipment and tools may pose shock or electrocution hazards to personnel. Safety-related work practices will be employed to prevent electric shock or other injuries resulting from direct or indirect electrical contact. If work on energized systems is necessary, these practices will conform to the requirements in the PRD-5099, "Electrical Safety"; MCP-3650, "Level I Lockouts and Tagouts," or MCP-3651, "Level II Lockouts and Tagouts"; facility supplemental MCPs; and Parts I through III of National Fire Protection Association (NFPA) 70E. In addition, all electrical work will be reviewed and completed under the appropriate work controls (i.e., HASP, SWPs, and work orders).

2.4.7.6 Personal Protective Equipment. Wearing PPE will reduce a worker's ability to move freely, see clearly, and hear directions and noise that might indicate a hazard. PPE can increase the risk of heat stress. Activities at the work site will be modified as necessary to ensure that personnel are able to work safely in the required PPE. Work-site personnel will comply PRD-5121, "Personal Protective Equipment," and MCP-432, "Radiological Personal Protective Equipment." The PPE levels for each task are described in Section 5.

2.4.7.7 Decontamination. Decontamination procedures for personnel and equipment are detailed in Section 11 and in the Phase I and Phase II tank farm soil and groundwater OU 3-14 RI/FS FSP (DOE-ID 2004b). These procedures are the primary decontamination method for all personnel and equipment that enter the EZ and radiological controlled areas. The appropriate BBWI MCPs provide additional directions for chemical and radionuclide decontamination.

When required, decontamination procedures (Section 11) and applicable MCPs must be followed and the appropriate level of PPE must be worn during decontamination activities. Project RadCon and IH personnel will follow MCP-148, "Personnel Decontamination"; Safety and Health Manual 14B; MCPs; and general IH practices.

2.4.8 Inclement Weather

When inclement or adverse weather, such as sustained strong winds 25 mph or greater, electrical storms, heavy precipitation, or extreme heat or cold, threatens people or property at the work site, the HSO, with input from the IH, safety engineer (SE), RCT, and other personnel, will evaluate weather conditions and decide whether to stop work, employ compensatory measures, or proceed. The FTL and HSO will comply with INEEL MCPs and site work control documents that specify limits for inclement weather.

During all site activities, the project HSO, in consultation with RadCon and IH personnel, will determine if wind or other weather conditions pose unacceptable hazards to personnel or the environment.

2.5 Other Site Hazards

Work-site personnel should continually look for potential hazards and immediately inform the FTL or HSO of the hazards so that action can be taken to correct the condition. The HSO, RCT, and FTL will be at the project site and visually inspect the site to ensure that barriers and signs are being maintained, unsafe conditions are corrected, and debris is not accumulating. The SE, HSO, or FTL will periodically inspect safety conditions in accordance with MCP-3449, "Safety and Health Inspections." Additionally, targeted and/or required self-assessments may be done during drilling operations in accordance with MCP-8, "Performing Management Assessments and Management Reviews." All inspections and assessments will be noted in the FTL logbook.

Health and safety professionals at the work site may, at any time, recommend changes in work habits to the FTL. However, all changes that may affect the project written work control documents (e.g., HASP, JSAs, RWPs, SWPs) must have concurrence from the appropriate project technical discipline representative onsite and a Document Action Request must be prepared as required. Personnel at the work site are responsible for using safe work techniques, reporting unsafe working conditions, and exercising good personal hygiene and housekeeping habits.

2.6 Rig Mobilization and Inspection

The subcontractor will perform a thorough inspection of drill/push probe rigs before mobilization and prior to use. The contractor will conduct document verification (e.g., rig inspection records and checklist) for the rig inspection. All deficiencies will be corrected in accordance with manufacturer specifications for the derricks at no cost to the contractor.

The subcontractor will notify the contractor a minimum of 5 days prior to mobilization. The contractor reserves the right to inspect the drilling and support equipment at the subcontractor's equipment yard prior to mobilization to the drilling site. If the equipment is located onsite at the INEEL, a premobilization inspection may be performed at the INEEL at the contractor's discretion. The contractor reserves the right to reject any equipment not in conformance with the subcontract.

2.6.1 Overhead Hazards

Personnel may be exposed to overhead impact (contact) hazards during the course of the project operations from walking in, between, and around operational equipment and support structures in the tank vault. Sources for these hazards will be identified and mitigated in accordance with PRD-5103, "Walking and Working Surfaces." In the case of overhead impact hazards, they will be marked by using engineering-controls protective systems where there is a potential for falling debris, in combination with head protection PPE.

3. EXPOSURE MONITORING AND SAMPLING

A potential for exposure to certain hazards (radiological, chemical, or physical) exists during project tasks while work proceeds in the proximity of the contaminated soil or material removal activities and may affect all personnel who work in the controlled work area or controlled contamination reduction zone and exclusion zone. Refinement of work control zones (see Section 7), use of engineering and administrative controls, worker training, and wearing PPE provide the mitigation strategy for these hazards. Monitoring and sampling will be used during project tasks to (1) assess the effectiveness of these controls, (2) determine the type of PPE needed for individual tasks, and (3) determine the need for upgrading and downgrading of PPE as described in Section 5. Monitoring will be conducted in and around the active work location(s) as frequently as determined appropriate by the RCT and IH.

Table 2-5 lists the tasks and hazards to be monitored and the monitoring instruments. Table 2-7 lists the action levels and associated responses for specific hazards.

3.1 Exposure Limits

Exposure limits identified in Table 2-7 serve as the initial action limits for specific chemical, physical, and radiological hazards. Other chemical or physical hazard action levels are established at one-half of the more stringent published permissible exposure limit (PEL) or threshold limit value (TLV). Project tasks will be continually assessed in accordance with PRD-25, "Activity Level Hazard Identification, Analysis, and Control," and evaluated by RadCon and industrial hygiene personnel to ensure engineering control effectiveness. Action limits should be adjusted as required based on changing site conditions, exposure mitigation practices, and PPE levels.

3.2 Environmental and Personnel Monitoring

The greatest potential for exposure to contaminants during OU 3-14 RI/FS activities is from contact with contaminated soil during soil vacuuming and subsequent sampling tasks. The HEPA-filtered vacuum extraction system, in combination with work control zones (Section 7), engineering and administrative controls, worker training and procedures, and use of protective equipment, will mitigate exposure potential to the degree possible.

RadCon and IH personnel will focus on soil vacuuming and sampling activities and monitoring with direct-reading instruments, collect swipes, and conduct full and partial period air sampling in accordance with applicable MCPs and other applicable guidelines. Monitoring with direct-reading instruments will be used to assess the effectiveness of controls and work practices. Monitoring will be site-specific with instrumentation listed on Table 2-6, selected on the basis of the conditions and contaminants associated with each task or location. The RCT and IH will be responsible for determining the best monitoring technique for radiological and nonradiological contaminants, respectively. Other support personnel (e.g., equipment operators, drillers) and the general work area may also be monitored to verify the integrity of engineering controls and to determine the effectiveness of contamination control and decontamination practices, if required.

Personnel working at the Phase I and Phase II tank farm soil and groundwater OU 3-14 RI/FS site may be exposed to hazardous materials or hazardous physical agents. Safety hazards and other physical hazards will be monitored and controlled as outlined in Section 2.4. Specific hazardous agent exposures that will be monitored are listed in Table 2-5. The IH and radiological monitoring are outlined in Sections 2.3.1 and 2.3.2, respectively.

4. ACCIDENT AND EXPOSURE PREVENTION

Project activities will present numerous safety, physical, chemical, and radiological hazards to personnel conducting these tasks. It is critical that all personnel understand and follow the site-specific requirements of this HASP. Engineering controls, hazard isolation, specialized work practices, and the use of PPE will all be implemented to eliminate or mitigate all potential hazards and exposures where feasible. However, all personnel are responsible for the identification and control of hazards in their work area in accordance with Integrated Safety Management System (ISMS) principles and practices. **At no time will hazards be left unmitigated without implementing some manner of controls (e.g., engineering controls, administrative controls, or the use of PPE).** Project personnel should use stop work authority in accordance with PRD-1004, "Stop Work Authority," or MCP-553, "Stop Work Authority," where it is perceived that immanent danger to personnel, equipment, or the environment exists.

This HASP is to be used in conjunction with PRD-25, "Activity Level Hazard Identification, Analysis, and Control," and work authorization and control documents such as STD-101, "Integrated Work Control Process"; work orders; JSAs; MCP-3562, "Hazard Identification, Analysis, and Control of Operational Activities"; and operational technical procedures. Where appropriate, MCP-3562; GDE-6212, "Hazard Mitigation Guide for Integrated Work Control Process"; mitigation guidance; JSAs; and RWPs will be incorporated into applicable sections of the HASP.

4.1 Voluntary Protection Program and Integrated Safety Management

ICP safety processes embrace the Voluntary Protection Program (VPP) and ISMS criteria, principles, and concepts to identify and mitigate hazards, thereby preventing accidents. All management and workers are responsible for implementing safety policies and programs and for maintaining a safe and healthful work environment. Project personnel are expected to take a proactive role in preventing accidents, ensuring safe working conditions for themselves and fellow personnel, and complying with all work control documents, procedures, and permits.

ISMS is focused on the **system** side of conducting operations and **VPP** concentrates on the **people** aspect of conducting work. Both programs define work scope, identify and analyze hazards, and mitigate the hazards. Additional information on these programs is available on the INEEL intranet. Bechtel BWXT Idaho, LLC (current primary management and operating contractor) and its subcontractors participate in VPP and ISMS for the safety of their employees. This document includes all elements of both systems. The five key elements of VPP and ISMS and their corresponding HASP sections are as follows:

Voluntary Protection Program	Integrated Safety Management System	Health and Safety Plan Section
	Define work scope	Section 1
Work site analysis	Analyze hazards	Sections 2, 3, 5, 8
Hazard prevention and control	Develop and implement controls	Sections 2, 3, 4, 5, 7, 10, and 11
Safety and health training	Perform within work controls	Section 6
Employee involvement	Perform within work controls	Sections 2, 3, and 4
Management leadership	Provide feedback and improvement	Sections 6 and 9

4.2 General Safe-Work Practices

Sections 1, 2, and 3 define the project scope of work and associated project-specific hazards and mitigation. The following practices are mandatory for all project personnel to further reduce the likelihood of accidents and injuries. All visitors permitted to enter work areas must follow these requirements. Failure to follow these practices may result in permanent removal from the project and other disciplinary actions. The project FTL/STR and HSO will be responsible to ensure that the following safe-work practices are adhered to at the project site:

- Limit work area access to authorized personnel only, in accordance with PRD-1007, "Work Coordination and Hazard Control," and Section 7.
- All personnel have the authority to initiate STOP WORK actions in accordance with PRD-1004 or MCP-553.
- Personnel will not eat, drink, chew gum or tobacco, smoke, apply sunscreen, or perform any other practice that increases the probability of hand-to-mouth transfer and ingestion of materials in designated work areas.
- Be aware of and comply with all safety signs, tags, barriers, and color codes as identified in accordance with PRD-2022, "Safety Signs, Color Codes, and Barriers," or PRD-5117, "Accident Prevention Signs, Tags, Barriers, and Color Codes."
- Be alert for dangerous situations, strong or irritating odors, airborne dusts or vapors, and spills. Report all potentially dangerous situations to the FTL/STR or HSO.
- Avoid direct contact with hazardous materials or wastes. Personnel will not walk through spills or other areas of contamination and will avoid kneeling, leaning, or sitting on equipment or surfaces that may be contaminated.
- Be familiar with the physical characteristics of the project site and/or facility, including, but not limited to
    - Prevailing wind direction
    - Location of fellow personnel, equipment, and vehicles
    - Communications at the project site and with INTEC
    - Area and type of hazardous materials stored and waste disposed of there
    - Major roads and means of access to and from the project site
    - Location of emergency equipment
    - Warning devices and alarms for area or facility
    - Capabilities and location of nearest emergency assistance.

- Report all broken skin or open wounds to the operations manager, FTL/STR, or HSO. An OMP physician must examine all wounds to determine the nature and extent of the injury. If required to enter into a radiological contamination area, the RadCon organization will determine whether the wound can be bandaged adequately in accordance with Article 316 of the INEEL Radiological Control Manual (PRD-183).

- Prevent releases of hazardous materials. If a spill occurs, personnel must try to isolate the source (if possible and if this does not create a greater exposure potential) and then report it to the FTL/STR and HSO. The Warning Communications Center (WCC) or INTEC shift supervisor or technical lead will be notified and additional actions will be taken, as described in Section 10. Appropriate spill response kits or other containment and absorbent materials will be maintained at the project site.

- Illumination levels during project tasks will be in accordance with 29 CFR 1910.120 (Table H-120.1, "Minimum Illumination Intensities in Foot-Candles").

- Ground-fault protection will be provided whenever electrical equipment is used outdoors.

- Keep all ignition sources at least 15 m (50 ft) from explosive or flammable environments and use nonsparking, explosion-proof equipment, if advised to do so by safety professionals.

- Follow all safety and radiological precautions and limitation of technical procedures and requirements identified in work packages.

4.3 Subcontractor Responsibilities

Subcontractors are responsible for meeting all applicable INEEL MCP, PRD, VPP, and ISMS flow-down requirements such as those listed on the completed INEEL Form 540.10A, "Subcontractor Requirements Manual Applicability"; "Subcontractor Requirements Manual" (TOC-59); and contract general and special conditions. Additionally, subcontractors are expected to take a proactive role in hazard identification and mitigation while conducting project tasks and to report unmitigated hazards to the appropriate project point of contact after taking mitigative actions within the documented work controls.

Subcontractors shall follow the equipment manufacturer's preventive maintenance recommendations and instructions, safe operating instructions, and other industry standard safe work practices for the equipment.

4.4 Radiation and Chemical Exposure Prevention

Exposure to potential chemical, radiological, and physical hazards will be mitigated by using engineering controls, administrative controls, or PPE to prevent exposures where possible or minimize them where engineering controls are not feasible. All project personnel are responsible for understanding the hazard identification and mitigation measures necessary to prevent exposures.

4.4.1 Radiation Exposure Prevention – As Low as Reasonably Achievable Principles

Radiation exposure of project personnel will be controlled such that radiation exposures are well below regulatory limits and no radiation exposure occurs without commensurate benefit. **Unplanned and preventable exposures are considered unacceptable.** All project tasks will be evaluated with the goal of eliminating or minimizing exposures. All project personnel are responsible to follow the ALARA principles and practices, and personnel working at the site must strive to keep both external and internal radiation doses ALARA by adopting the following practices discussed in the next two sections.

4.4.1.1 External Radiation Dose Reduction. Radiological work permits will be written as required for project tasks that will define hold points, required dosimetry, RCT coverage, radiological areas, and radiological limiting conditions in accordance with MCP-7, "Radiological Work Permit." Radiological control personnel will participate in the prejob briefing required by MCP-3003, "Performing Prejob Briefings and Postjob Reviews," to ensure all personnel understand the limiting conditions on the RWP. All personnel must read and sign the RWP (or scan the RWP bar code) acknowledging that they understand the requirements specified on the RWP prior to performing work.

Basic protective measures used to reduce external doses include (1) minimizing time in radiation areas, (2) maximizing the distance from known sources of radiation, and (3) using shielding whenever possible. The following are methods to minimize external dose:

Methods for Minimizing Time

- Plan and discuss the tasks before entering a radiation area (including having all equipment and tools prepared).
- Perform as much work as possible outside radiation areas and take advantage of lower dose rate areas (as shown on the radiological survey maps).
- Take the most direct route to the tasks and work efficiently.
- If problems occur in the radiation areas, hold technical discussions outside radiation areas, then return to the work area to complete the task.
- If stay times are required, know your stay time and use appropriate signal and communication methods to let others in the area know when the stay time is up.
- Respond to electronic dosimetry alarms by notifying others in the area and the RCT and exit the radiation area through the designated entry and exit point.
- Know your current dose and your dose limit. DO NOT EXCEED YOUR DOSE LIMIT.

Methods for Maximizing Distance from Sources of Radiation

- Use remote-operated equipment or controls where required.
- Stay as far away from the source of radiation as possible (extremely important for point sources where, in general, if the distance between the source is doubled, the dose rate falls to one-fourth of the original dose rate).

- Become familiar with the radiological survey map for the area in which work will be performed, as well as high and low dose-rate locations, and take advantage of low dose rate areas.

Proper Use of Shielding

- Know what shielding is required and how it is to be used for each radiation source.
- Take advantage of the equipment and enclosures for shielding yourself from radiation sources.
- Wear safety glasses to protect eyes from beta radiation.

4.4.1.2 Internal Radiation Dose Reduction. An internal radiation dose potential exists during soil vacuum excavation, drum handling activities, and soil sampling activities/testing and is described in the OU 3-14 RI/FS (DOE-ID 2004a). An internal dose is the result of radioactive material being taken into the body. Radioactive material can enter the body through inhalation, ingestion, absorption through wounds, or injection from a puncture wound. Reducing the potential for radioactive material to enter the body is critical to avoid an internal dose. The following are methods to minimize internal radiation dose hazard:

- Know the potential and known contamination sources and locations, and minimize or avoid activities in those areas
- Wear protective clothing and respiratory protection as identified on the RWP, perform all respirator leak checks, and inspect all PPE before entering contaminated areas or areas with airborne radioactivity
- Use a high-efficiency particulate air (HEPA) filter exhaust system
- When inside contaminated areas, do not touch your face (adjust glasses or PPE) or other exposed skin
- When exiting contaminated areas, follow all posted instructions and remove PPE in the order prescribed (if questions arise, consult RadCon personnel)
- Conduct a whole-body personnel survey when exiting the contaminated area, then proceed directly to the personnel contamination monitor
- Report all wounds or cuts (including scratches and scrapes) before entering radiologically contaminated areas
- Wash hands and face before eating, drinking, smoking, or engaging in other activities that may provide a pathway for contaminants.

Monitoring for radiation and contamination during project tasks will be conducted in accordance with the RWP; PRD-183, "Radiation Protection - INEEL Radiological Control Manual"; "Radiation Protection Procedures" (Manual 15B); and "Radiological Control Procedures" (Manual 15C), and as deemed appropriate by RadCon personnel.

4.4.2 Chemical and Physical Hazard Exposure Avoidance

Note: Identification and control of exposures to carcinogens will be conducted in accordance with MCP-2703, "Carcinogens."

Threshold-limit values (TLVs) or other occupation exposure limits have been established for numerous chemicals and physical agents (e.g., noise, heat, or cold stress) that may be encountered. These exposure limits provide guidelines for evaluating airborne, skin, and physical agent exposures. The TLVs represent levels and conditions to which it is believed that nearly all workers may be exposed day after day without adverse health effects. The TLV time-weighted average (TLV-TWA) is a time-weighted average concentration for a conventional 8-hour workday and a 40-hour workweek, to which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse health effects. Action limits (instantaneous concentrations for short time periods) have been established (Section 3) to further reduce the likelihood of exceeding TLVs.

Controls will be employed to eliminate or mitigate chemical and physical hazards wherever feasible. The hierarchy of controls in order are (1) engineering controls, (2) administrative controls, and (3) PPE. In addition to these controls, use of technical procedures and work orders, hold points, training, and monitoring of hazards will be used as appropriate to reduce exposure potential. Some methods of exposure avoidance include

- Wearing all required PPE, inspecting all pieces before donning, and taping all seams
- Changing PPE if it becomes damaged or shows signs of degrading
- Minimizing time in direct contact with hazardous material or waste
- Doffing PPE following standard practices (i.e., rolling outer surfaces in and down) and following doffing sequence
- Washing hands and face before eating, drinking, smoking, or engaging in other activities that may provide a pathway for contaminants.

4.5 Buddy System

The two-person or buddy system will be used during project tasks. The buddy system is most often used during project activities requiring the use of protective clothing and respiratory protection where heat stress and other hazards may impede a person's ability to self-rescue. The buddy system requires each employee to assess and monitor his or her buddy's mental and physical well being during the course of the operation. A buddy must be able to perform the following activities:

- Provide assistance if required
- Verify the integrity of PPE

- Observe his or her buddy for signs and symptoms of heat stress, cold stress, or contaminant exposure

- Notify other personnel in the area if emergency assistance is needed.

The buddy system will be administered by the FTL/STR in conjunction with the HSO.

5. PERSONAL PROTECTIVE EQUIPMENT

The primary hazards associated with Phase I and Phase II tank farm soil and groundwater activities for the OU 3-14 RI/FS relate to industrial safety (e.g., drill rig operation, material handling, and vehicle operation). Additional potential hazards exist from contact with contaminated soil during investigation activities, particularly soil vacuum extraction operations, drummed soil sampling, and sampling equipment decontamination. Anyone entering the CRZ and EZ must be protected against potential safety and contaminant exposure hazards. Each task associated with drilling and sampling operations is unique and the required PPE will be dependent upon type of task, proximity to the hazard, and potential for exposure. This section discusses PPE to be worn for investigation and sampling tasks and contingencies for upgrading and downgrading PPE.

The purpose of PPE is to shield or isolate personnel from chemical, radiological, physical, and biological hazards that cannot be eliminated or controlled though engineering or other practices. It is important to realize that no one PPE ensemble can protect against all hazards under all conditions and that proper work practices and adequate training will augment PPE to provide the greatest level of protection to workers.

Selection of the proper PPE to protect project site personnel is based on the following:

- Specific conditions and nature of the drilling and sampling-related task (e.g., well installation, sampling, handling, equipment decontamination)
- Radiological and nonradiological materials and agents associated with the WAG 3 OU 3-14 tank farm area soil
- Contaminant routes of entry
- Physical form and chemical characteristics of contaminants
- Acute and chronic effects from exposure to contaminants
- Local and systemic toxicity of contaminants
- Anticipated exposure levels (surface and airborne)
- The hazard analysis (Section 2) evaluation of this HASP.

If radiological contamination is encountered at levels requiring the use of protective clothing, these requirements will be stated in a task-specific RWP developed in accordance with MCP-432, "Radiological Personal Protective Equipment."

PPE is generally divided into two broad categories: (1) respiratory protective equipment and (2) personal protective clothing. Both categories are incorporated into the traditionally recognized four levels of personal protection equipment (Levels A, B, C, and D). Table 5-1 provides guidance for selecting respiratory and protective clothing. Based on contaminants (identified from previous characterization) in the tank farm soil that will be disturbed, a combination of PPE Level D and modified Level D is anticipated. However, respiratory protection may be required if contaminants are detected above established action levels or if engineering controls fail to reduce contaminant concentrations below the action levels. The Phase I and Phase II tank farm soil and groundwater OU 3-14 site will be monitored by sampling support personnel (RadCon and IH) to evaluate changing conditions and to determine the most appropriate PPE level (including modifications). Task-based PPE (respiratory protection and protective clothing) required and potential upgrades are listed in Table 5-2.

Table 5-1. Respiratory and protective clothing selection guidance.

Hazard	Level of Protection
Respiratory PPE selection [a]	
Not immediately dangerous to life or health (IDLH) or oxygen-deficient atmospheric conditions. Gaseous, vapor, particulate and/or aerosol chemicals/radionuclides.	Level C—full-facepiece, as determined by IH/RCT Level B—full-facepiece supplied air respirator with an air-purifying escape cartridge or airhood (bubblehood) HEPA/chemical combination cartridge for concentrations up to the protection factor of an air-purifying full-facepiece respirator and within the assigned DAC [b] value
IDLH or oxygen-deficient atmospheric conditions. Gaseous, vapor, particulate and/or aerosol chemicals/radionuclides.	Level B—full-facepiece, supplied air respirator with an escape-only SCBA[c] or Level A—self-contained breathing apparatus HEPA/chemical combination cartridge for concentrations up to the protection factor of an air-purifying full-facepiece respirator and within the assigned DAC [b] value
Protective clothing selection	
Low atmospheric contaminant levels under stable conditions. No anticipated immersion, splashes, or potential for unexpected contact with chemical or radiological contaminants.	Level D
Moderate atmospheric contaminants under relatively stable conditions, liquid splashes or other direct contact that do not have corrosive characteristics or can be absorbed by exposed skin. Low potential for contact with radionuclide-contaminated materials.[d]	Level C (Contingency only)
Moderate to high atmospheric contaminants under unstable conditions, potential for contact with wet, contaminated surfaces/material that can saturate or permeate Level C protective clothing. Moderate potential for contact with radionuclide-contaminated materials.[d]	Level B[e] (Not anticipated to be worn)
High and unknown atmospheric contaminants, potential for contact with substances that pose a high hazard potential to the skin, high potential for splash, immersion, or exposure to unexpected vapors, gases, aerosols, or dusts that may present an IDLH situation/readily absorbed through the skin. High potential for contact with radionuclide-contaminated materials.[d]	Level A[e] (Will not be worn)

a. A multichemical/high-efficiency particulate air (HEPA) combination cartridge to be selected by IH and RadCon personnel based on specific task hazards.

b. Derived air concentration (DAC) based on specific radionuclides.

c. SCBA = self-contained breathing apparatus.

d. Contamination levels and airborne radioactivity as outlined in PRD-183.

e. Levels A and B PPE are not anticipated to be required for personnel conducting Phase I and Phase II tank farm soil and groundwater OU 3-14 RI/FS tasks.

Table 5-2. Phase I and Phase II tank farm soil and groundwater OU 3-14 RI/FS task-based PPE requirements and modifications.

Task	Level of PPE	Primary or Contingency	Modifications and Comments
Tasks with low potential for airborne radioactivity or contact with contaminated soil			
Site preparation	Level D	Primary	Level D PPE as defined in Section 5.2.1. Modification for specific hand protection for personnel will be defined in the JSA and/or RWP.
Probe installs	Modified Level C	Primary	Level C Modified without respiratory protection unless airborne levels above action limits.
Logging	Modified Level D	Upgrade contingency	Upgrading to modified Level D (protective clothing, Tyvek coveralls or equivalent) may be required if contamination (radiological or nonradiological) is detected.
Sample tasks outside EZ	Level C	Upgrade contingency	If airborne radioactivity increase to concentrations above established action limits, Level C full-face air-purifying respiratory protection (chemical/radiological combination cartridge) will be worn in conjunction with chemical protective clothing.
Tasks with moderate to high potential for airborne radioactivity or contact with contaminated soil			
Soil vacuum extraction	Modified Level C	Primary	Modified Level D (coveralls, Tyvek coveralls or equivalent), taped at seams if contamination (radiological or nonradiological) is detected and contact with environmental media cannot be avoided. Additional Level D modification for specific hand/face protection for samplers and personnel conducting decontamination may be defined by JSA and /or RWP.
Sampling drummed soil	Level D	Primary	
Equipment decontamination	Modified Level D	Primary	
Rinsate sampling preservation	Level C	Upgrade contingency	If airborne radioactivity increase to concentrations above established action limits, Level C full-face air-purifying respiratory protection (chemical/radiological combination cartridge) will be worn in conjunction with chemical protective clothing.

5.1 Respiratory Protection

IH and RCT monitoring will focus on moderate- to high-potential hazard activities (see Table 5-2) to verify airborne contaminants are below the action limits. Respiratory protection will be made available only as a contingency if action limits are exceeded or site conditions change such that additional respiratory protection is required (i.e., upgrading is necessary). If respiratory protection is required, assigned protection factors for respiratory devices listed in Table 5-3 will not be exceeded.

Table 5-3. Assigned protection factors for respiratory devices.[a]

Type of Respirator	Respiratory Inlet Covering (full facepiece)	
Full-face air-purifying with appropriate cartridge	Chemical agents 100[b]	Radionuclides 100[c,d]

a. ANSI Z88.2-1992.

b. BBWI MCP-2726.

c. Particulates only. When HEPA filters are used in atmospheres not containing radioactive gas.

d. BBWI MCP-432.

Personnel required to wear respirators will complete a medical examination, complete training, and be fit-tested before being assigned a respirator. Directions for respirator use, emergency use, storage, cleaning, and maintenance, as stated in PRD-2109 and MCP-2726, "Respiratory Protection," will be followed.

5.2 Personal Protective Equipment Levels

The following sections explain the four levels of PPE in detail. Modifications to these levels will be made under the direction of the HSO in consultation with the project IH and RadCon personnel, as appropriate. Such modifications are routinely employed during HAZWOPER site activities to maximize efficiency and to meet site-specific needs without compromising personnel safety and health. Based on the potential for creating airborne dust and contact with soil, special attention will be given to both respiratory and protective clothing contingencies. Table 5-2 lists each task or assignment and the corresponding level of PPE, as well as any additional or special items necessary for personal protection at the work site. The HSO, IH, and RadCon personnel will determine what modifications to the PPE levels listed on Table 5-2 are appropriate.

5.2.1 Level D Personal Protective Equipment

Level D or modified Level D will be the primary PPE level for Phase I and Phase II tank farm soil and groundwater OU 3-14 RI/FS activities. Level D PPE will only be selected as a work uniform and not on a site with respiratory or skin absorption hazards requiring whole body protection. This level provides no protection against airborne chemical hazards but, rather, is used for protection against nuisance contamination and physical hazards. Level D PPE will only be allowed in areas that have been characterized or are known to have never been contaminated.

Level D or modified Level D PPE will be the primary level of protective clothing and equipment worn for most tasks. The Level D PPE ensemble may be modified by the IH and/or the RCT to protect the skin or to protect from other physical hazards, but will not include the addition of respiratory protection.

- Level D PPE consists of the following:
  - Coveralls or standard work clothes (as determined by the IH and/or RCT)
  - Hard hat (as required by SE and type of work being performed)
  - Eye protection, safety glasses with side shields as a minimum (see PRD-5121, "Personal Protective Equipment")

- Hand protection for all material-handling tasks (leather or other material specified by the IH)
- Safety footwear (steel or protective toe and shank, as determined by the SE).

- Optional Level D modifications consist of the following:
    - Chemical or radiological protective clothing (e.g., Tyvek and Saranex) as prescribed in site-specific RWP or SWP
    - Chemically resistant hand and foot protection (e.g., inner/outer gloves and boot liners)
    - Radiological modesty garments under outer protective clothing
    - Any specialized protective equipment (e.g., hearing protection and face shields).

5.2.2 Level C Personal Protective Equipment

Level C PPE will be worn when the work site chemical and/or radiological contaminants have been well characterized (indicating that personnel are protected from airborne exposures by wearing air-purifying respirators with the appropriate cartridges), no oxygen-deficient environments exist (<19.5% at sea level), and no conditions pose immediate dangers to life or health (IDLH). Basic Level C PPE includes the following:

- Level D ensemble (with the following respiratory and whole body protection upgrades):
    - Full-facepiece air-purifying respirator equipped with a NIOSH-approved cartridge (IH to specify type of cartridge [organic vapor, HEPA, or combination])
    - Chemical-resistant coveralls (e.g., Tyvek QC, Tychem 7500, and Saranex-23-P) as prescribed in site-specific RWP or SWP (IH to specify material)
    - Chemical-resistant outer shoe/boot cover (IH and/or RCT to specify material)
    - Inner chemical-resistant nitrile rubber gloves with cotton liners (as determined by the IH and/or RCT)
    - Outer chemical-resistant Viton or polyvinyl alcohol gloves (as determined by the IH).
- Optional Level C modifications include the following:
    - Radiological modesty garments under outer protective clothing
    - Any specialized protective equipment (e.g., hearing protection and aprons).

5.3 Protective Clothing Upgrading and Downgrading

The Phase I and Phase II tank farm soil and groundwater remedial investigation HSO, in consultation with the project IH and RadCon personnel, will be responsible for determining when to upgrade or downgrade PPE requirements. Upgrading or downgrading PPE requirements based on current conditions is a normal occurrence. Action levels, listed in Table 2-7, provide the chemical and radiological basis for determining such decisions. If changing conditions are encountered, new work control documents (e.g., SWPs, RWPs, JSAs) may need to be written or revised to reflect these changes. If PPE is upgraded or downgraded, the project HSO will consult with RadCon personnel to evaluate RWP requirements.

Additional reasons for upgrading or downgrading include

- Upgrading criteria or conditions (work will stop immediately if an upgrade in PPE is required)
    - Unstable or unpredictable site radiological and/or nonradiological hazards
    - Contaminants difficult to monitor or detect
    - Known or suspected skin absorption hazards
    - Temporary loss or failure of any engineering controls
    - Identified source or potential source of respiratory hazards
    - Change in the task that may increase contact with contaminants or may meet any of the criteria listed above.
- Downgrading criteria
    - New information or monitoring data that show contaminant levels to be consistently lower than established action limits
    - Implementation of new engineering or administrative controls that eliminate or significantly mitigate hazards
    - Elimination of potential skin absorption or contact hazards
    - Change in site conditions that results in removal of physical hazards or reduces or isolates them to a controlled area
    - Completion or change in tasks that results in the elimination of key hazards that require higher levels of PPE.

5.4 Inspection of PPE

All PPE ensemble components must be inspected both prior to use and when in use within project work zones. Once PPE is donned, self-inspection and the use of the buddy system will serve as the principal forms of inspection. If, at any time, PPE should become damaged or degradation or permeation is suspected, an individual will inform others of the problem and proceed directly to the work zone exit point to doff and replace the unserviceable PPE. Additionally, all PPE that becomes grossly contaminated or presents a potential source for the spread of contamination will be decontaminated or replaced as directed by the HSO or RCT, as appropriate. Table 5-4 provides an inspection checklist for common PPE items.

Table 5-4. PPE inspection checklist.

PPE Item	Inspection
Gloves	Before use: Pressurize gloves to check for pinholes: blow in the glove, then roll until air is trapped and inspect. No air should escape. Visually inspect leather gloves for integrity. While wearing in the work zone: Inspect for tears, punctures, and damage. Check all taped areas to ensure gloves are still intact.
Respirators (full-facepiece air-purifying)	Before use: Check condition of the facepiece, head straps, valves, connecting lines, fittings, all connections for tightness. Check cartridge to ensure proper type/combination for atmospheric hazards to be encountered, inspect threads and O-rings for pliability, deterioration, and distortion. While wearing in the work zone: Check to ensure no leakage can be detected and straps are secure. If breathing resistance or chemical break-through is experienced, exit the area following posted doffing instructions and report problem to IH.
Modified Levels D and C protective clothing	Before use: Visually inspect for imperfect seams, nonuniform coatings, tears, etc. Hold PPE up to the light and inspect for pinholes, deterioration, stiffness, and cracks. While wearing in the work zone: Check for evidence of chemical attack, such as discoloration, swelling, softening, and material degradation. Inspect for tears, punctures, and zipper or seam damage. Check all taped areas to ensure they are still intact.